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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

Marine Flora and Fauna of the Northeastern United States. Higher Plants of the Marine Fringe

EDWIN T. MOUL

PENNSYLVANIA STATE UNIVERSITY
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U.S. DEPARTMENT OF COMMERCE
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EDWIN T. MOUL
Illustrations by Ruth von Arx

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FOREWORD

This issue of the "Circulars" is part of a subseries entitled "Marine Flora and Fauna of the Northeastern United States." This subseries will consist of original, illustrated, modern manuals on the identification, classification, and general biology of the estuarine and coastal marine plants and animals of the Northeastern United States. Manuals will be published at irregular intervals on as many taxa of the region as there are specialists willing to collaborate in their preparation.

The manuals are an outgrowth of the widely used "Keys to Marine Invertebrates of the Woods Hole Region," edited by R. I. Smith, published in 1964, and produced under the auspices of the Systematics-Ecology Program, Marine Biological Laboratory, Woods Hole, Mass. Instead of revising the "Woods Hole Keys," the staff of the Systematics-Ecology Program decided to expand the geographic coverage and bathymetric range and produce the keys in an entirely new set of expanded publications.

The "Marine Flora and Fauna of the Northeastern United States" is being prepared in collaboration with systematic specialists in the United States and abroad. Each manual will be based primarily on recent and ongoing revisionary systematic research and a fresh examination of the plants and animals. Each major taxon, treated in a separate manual, will include an introduction, illustrated glossary, uniform originally illustrated keys, annotated check list with information when available on distribution, habitat, life history, and related biology, references to the major literature of the group, and a systematic index.

These manuals are intended for use by biology students, biologists, biological oceanographers, informed laymen, and others wishing to identify coastal organisms for this region. In many instances the manuals will serve as a guide to additional information about the species or the group.

Geographic coverage of the "Marine Flora and Fauna of the Northeastern United States" is planned to include organisms from the headwaters of estuaries seaward to approximately the 200-m depth on the continental shelf from Maine to Virginia, but may vary somewhat with each major taxon and the interests of collaborators. Whenever possible representative specimens dealt with in the manuals will be deposited in reference collections of the Gray Museum, Marine Biological Laboratory, and other universities and research laboratories in the region.

After a sufficient number of manuals of related taxonomic groups have been published, the manuals will be revised, grouped, and issued as special volumes. These volumes will thus consist of compilations of individual manuals within phyla such as the Coelenterata, Arthropoda, and Mollusca, or of groups of phyla.

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MARINE FLORA AND FAUNA OF THE NORTHEASTERN UNITED STATES.
Higher Plants of the Marine Fringe

EDWIN T. MOUL[1]

ABSTRACT

The common higher plants of the beaches, dunes, morainal cliffs, and tidal marshes of Southern New England are treated in an illustrated key, using only vegetative characters. Both scientific and common names are given. Habitat lists of the plants are included, presenting to the investigator the association of plants as they occur in nature. The range of each plant along the Atlantic coast is designated. A glossary of terms is included.

INTRODUCTION

The marine environment in southern New England is bordered by beaches, dunes, tidal marshes, and morainal cliffs. In these various types of harsh habitats a limited number of higher plants are able to grow and flourish, resisting wind and salt spray.

The illustrated key on the following pages was prepared for the identification of most of the higher plants growing on this marine fringe. The characters employed in the key are vegetative, principally leaf form, and occasionally root and stem features. The use of these characteristics not only makes the key less technical, but permits the identification of plants without flowers and fruits. The key is designed for biologists, biology students, and amateur botanists. A glossary of the few technical terms employed, as well as diagrams illustrating the main characters used to describe leaf shapes (Plate I), are provided.

A systematic list of plants has been omitted. Instead plants are arranged in lists according to the habitats in which they grow. This method of listing is useful to the investigator as it presents the association of plants as they occur together in nature.

After the name of each species in the habitat list is given the geographic distribution of the plant along the Atlantic coast as recorded in "Gray's Manual of Botany" (Fernald, 1950). Although "Higher Plants of the Marine Fringe" has been designed primarily for use in southern New England, the information on distribution will give it wider application to the north and to the south. The key has been tested primarily on Cape Cod and has also been found usable in Maine, New Jersey, and Delaware. However, the user should be cautioned that species of plants will be found both north and south of southern New England which are not included in the key. While most of the plants in the key are wide ranging, a few are restricted to our northern shores. Frequently, mention is made of species of a genus not included in the key that may occur in southern New England or outside the range of this key.

The majority of plants included here are the spermatophytes or flowering plants. Only one fern occurring in the dune habitat is listed. A few mosses and lichens that are characteristic of dune bogs and two algae that are integral parts of the flora of tidal marshes are mentioned in the habitat lists, but not in the key.

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The type of key used in this manual is probably familiar to most investigators. It consists of two statements of contrasting characters. The user makes a choice of the one which fits the plant in hand. This will lead to a number which will take him to another pair of characters where he again makes a choice. This eventually leads to a specific plant name. In order to permit working in reverse, the number of the preceding character is given in parenthesis.

A complete collection of the plants included in this key has been deposited in the Herbarium of the Gray Museum, Marine Biological Laboratory.

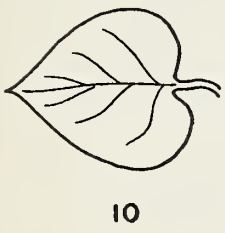
GLOSSARY

The use of technical botanical terms has been kept to a minimum. Those found to be necessary are included in this glossary. Terms used to describe leaf shapes, tips, and margins, and the juncture of sheath and blade in grasses are illustrated in Plate I.

achene a small, dry, one-seeded fruit that does not open at maturity.
acuminate see Plate I.
acute see Plate I.
apical relating to the apex or tip.
auricle an ear shaped appendage or lobe (see grass, Plate I).
axile in the angle between two structures.
bract a modified leaf subtending a flower, sometimes on the stem.
capsule a dry fruit thát opens when ripe and with more than one-seed cavity.
caudex the persistent base, sometimes woody, of an herbaceous stem.
clasping in which the base of the leaf partially encircles the stem (see Fig. 47).
corymb a flat topped or convex open flower cluster.
cryptogams lower plants, nonflowering.
deciduous not persistent, not evergreen.
dioecious male and female elements in separate plants (two households).
drupe a fleshy fruit with a stone seed.
filiform threadlike.
glume a chafflike bract at the base of the spiklet in grasses.
imbricated overlapping.
involute rolled inward.
leaf shapes and margins see Plate I.
lenticels corky spots on the young bark of trees and shrubs.
ligule a projection from the summit of the sheath in grasses (see Plate I); the flattened limb of the ray flower of compositae.
node place on a stem where leaves or buds occur.
ocreaé a tabular stipule, or a pair of stipules, joined and elongated.
panicle a loose irregular compound flower cluster with flowers on small stems.
pappus appendages in tufts at top of ovary or fruit of such plants as thistle and dandelion. Usually cottony and useful in the dispersal of the fruits or seeds.
pedicel the stem of a single flower in a cluster.
peduncle the stem of a single flower.
petiole the stem of a leaf.
pome a fleshy fruit like an apple.
pubescent covered with short, soft hairs.
raceme a flower cluster of stemmed flowers on an elongated axis.
rachis the axis of a compound leaf.
rhizome a prostrate, subterranean stem, rooting at nodes.
rugose wrinkled.
scabrous rough to the touch.
scape a naked flower stem rising from the ground.
sepal a leaf like outer division of the flower, often green.
sessile without an individual stem, as a leaf attached directly to main stem.
setaceous bristle shaped.
silique a specialized capsule in which a partition separates each seed cavity; characteristic of Cruciferae.
spike an elongated flower axis in which the flowers are sessile or almost sessile.
stipule an appendage at the base of the petiole or leaf or at each side of the attachment to the main stem (see Fig. 6, 7).
terete cylindrical, having a circular cross section.
umbel a flower cluster in which the individual flower stems arise from the same level (Flower of Wild Carrot).
veins the conducting tissue in a leaf.
villous bearing long and soft hairs.
whorl three or more leaves in a circle around the stem (at the node).

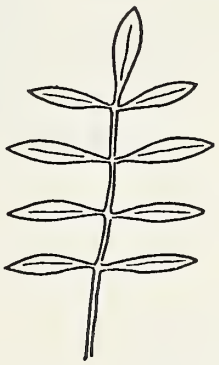
LEAF SHAPES

1. linear
2. lanceolate
3. oblanceolate
4. spatulate
5. oblong
6. ovate
7. obovate
8. deltoid
9. hastate

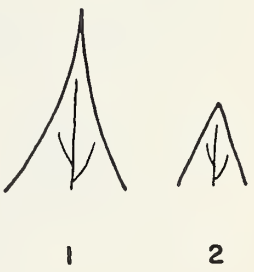


10. cordate

11. palmately compound

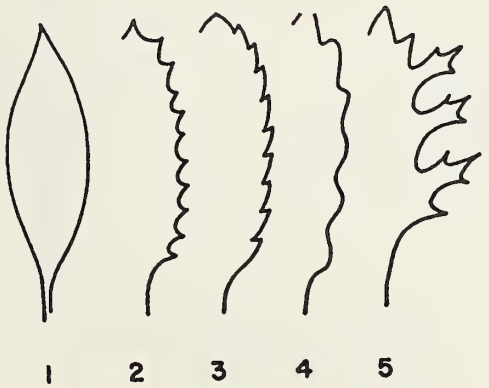


12. pinnately compound



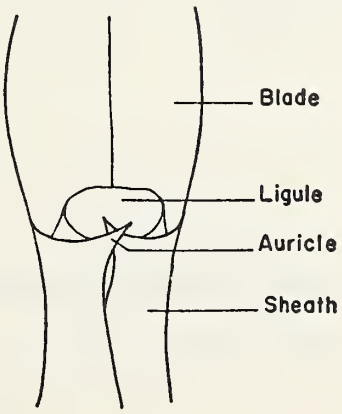
LEAF TIPS

1. acuminate
2. acute



LEAF MARGINS

1. entire
2. dentate
3. serrate
4. sinuate
5. pinnate



Junction of blade and sheath in grasses

Plate I.—Examples of leaf shapes, leaf margins, leaf tips, and junction of blade and sheath in grasses referred to in the glossary.

VEGETATIVE KEY TO HIGHER PLANTS OF BEACHES, DUNES, AND TIDAL MARSHES

1 Woody plants, trees and/or shrubs more than 2 ft tall. 2
(Caution: before proceeding, see description of Poison Ivy in couplet 6 below; also a few herbaceous plants have a woody caudex or underground basal woody structure.)

1 Herbaceous plants. 24

2 (*1*) Needle or scale leaved trees, evergreen; cones or berrylike cones present. 3

2 (*1*) Broad leaved trees or shrubs, cones or berrylike cones not present. 4

3 (*2*) Needle leaves in bundles of three; seeds in a cone. .....*Pinus rigida*, Pitch Pine

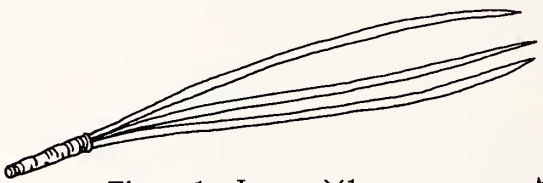


Figure 1.—Leaves ×1.

3 (*2*) Scaly leaves, opposite or in whorls of three, spiny on juvenile stems, adpressed to twigs on mature stems; berrylike cone. .....*Juniperus virginiana*, Red Cedar

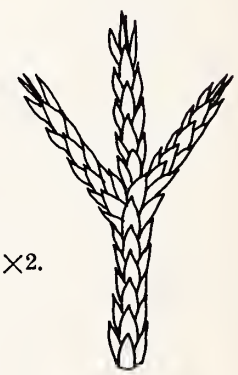


Figure 2.—Mature twig ×2.

4 (*2*) Simple leaves (single blade) (see Fig. 8, 9). 9

4 (*2*) Compound leaves (three or more leaflets to a blade) (see Fig. 4, 5). 5

5 (*4*) Palmately compound or trifoliate leaves (see Fig. 3, 4). 6

5 (*4*) Pinnately compound leaves (see Fig. 5). 7

6 (5) Shrubby to vinelike plants with three leaflets which are dark green and shiny above, orange to scarlet foliage in the fall; POISONOUS TO TOUCH; clusters of yellowish flowers below the leaves; fruit berrylike, yellow to white. ..... *Rhus radicans*, Poison Ivy

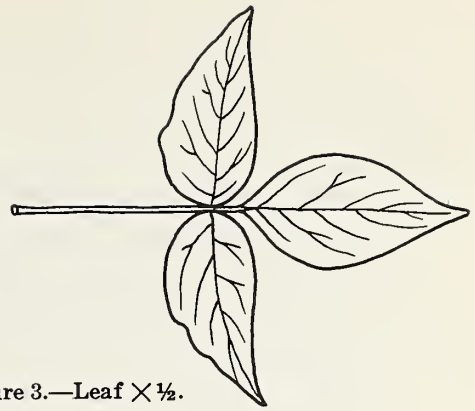


Figure 3.—Leaf × ½.

6 (5) Vinelike plants with leaves of five leaflets which are light green above and have serrate edges; scarlet foliage in the fall; tendrils with adhesive disks; flowers in a panicle; fruit a blueberry. ..... *Parthenocissus quinquefolia*, Virginia Creeper or Woodbine.

Figure 4.—Leaf × ⅔

7 (5) Shrub to about 10 m high, lacking thorns; 7-23 linear, oblong, entire leaflets with wing margined rachis (leaf stem); flowers terminal, pyramidal, yellowish to green; a hairy red drupelike fruit. ..... *Rhus copallina*, Dwarf Sumac

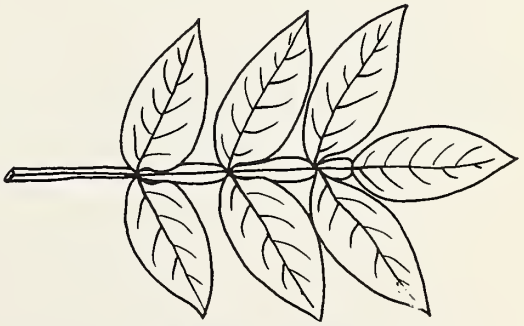


Figure 5.—Leaf × ½.

7 (5) Shrubby plants with thorns; five to nine leaflets; large persistent stipules at base of compound leaves; rose colored flowers (sometimes white). 8

8 (7) Leaflets coarse, dark green above, light green below, to 5 cm long; many thorns, large and small on stem; flowers rose or white; large red applelike fruit (hips) to 3 or 4 cm broad; usually forming thickets on dunes and resistant to salt spray. .....*Rosa rugosa*, Salt-Spray Rose

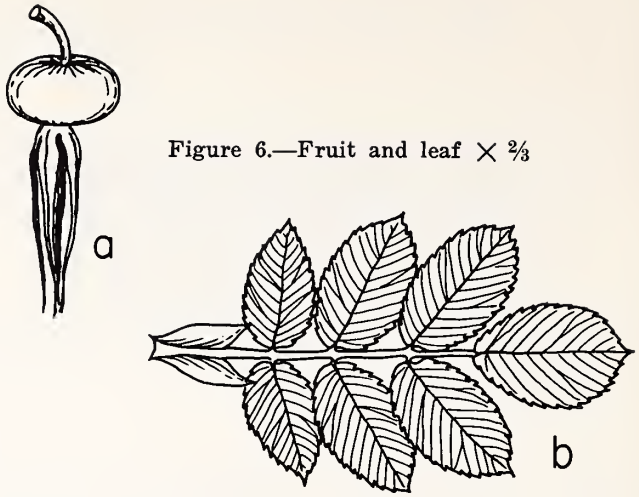


Figure 6.—Fruit and leaf × ⅔

8 (7) Leaflets finer, light green above and below, coarsely serrate with 5-15 teeth above middle, to 3 cm long; thorns at nodes only; flowers rose; a small applelike fruit to 1 cm broad; plants of upland borders of dunes and marshes. .....*Rosa palustris*, Swamp Rose (other members of genus may be present)

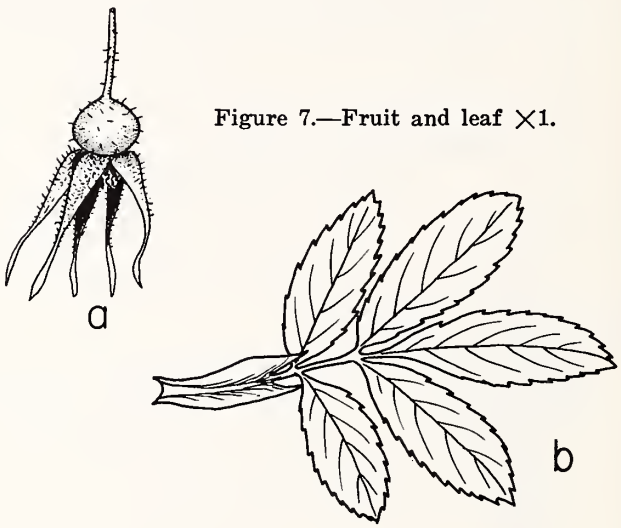


Figure 7.—Fruit and leaf ×1.

9 (4) Maritime shrubs 2-12 ft tall; on higher ground in the tidal marshes and edge of dunes; stems light tan and smooth; leaves fleshy and thick to the touch; light green in color; flowers greenish. 10

9 (4) Shrubs and trees on dunes, many not restricted to maritime habitat; leaves not fleshy and thick to touch; flowers variable in color. 11

10 (*9*) Leaves opposite (at least below), lanceolate, sharply 6-15 toothed on each side, 2-5 cm broad; prominently 3-veined (nerved); plants primarily at ditch edge and higher ground in tidal marshes. ....*Iva frutescens* var. *oraria,* Marsh Elder, High Tide Bush

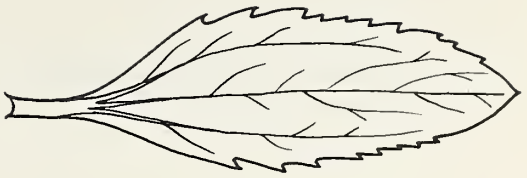


Figure 8.—Leaf ×1.

10 (*9*) Leaves alternate, obovate or deltoid-obovate, coarsely dentate (toothed) on upper two-thirds of leaf; plants dioecious (male and female separate); white fluffy pappus on the achenes of female plant in the fall. .....*Baccharis halimifolia,* Sea Myrtle, Groundsel Tree

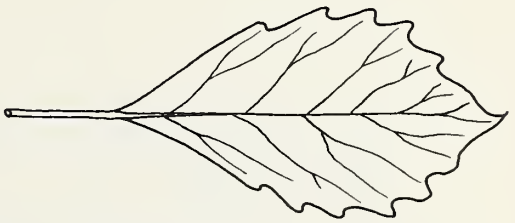


Figure 9.—Leaf ×1.

11 (*9*) Trees only (single main stem). 12

11 (*9*) Shrubs only (several main stems). 18

12 (*11*) Simple ovate leaves, entire or with two or three apical lobes all on the same tree; bark spicy-aromatic; young twigs green; fruit an ovoid blue drupe. ....*Sassafras albidum,* Sassafras

Figure 10.—Leaves ×½.

12 (*11*) Simple leaves, but without apical lobes. 13

13 (*12*) Leaves with a stiff leathery texture and somewhat lobed; trees of the dunes and hollows. 14

13 (*12*) Leaves not leathery, simple and not lobed. 15

14 (*13*) Leaves with heavy spiny teeth at the end of shallow lobes, dark green above, light green below. .....*Ilex opaca*, American Holly

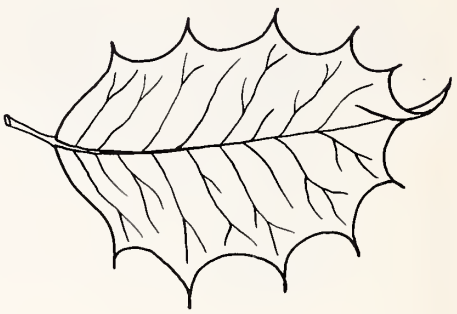


Figure 11.—Leaf ×1.

14 (*13*) Leaves lobed with a bristle at the end of the lobe, dark green above, dense wooly hairy below; fruit an acorn. .....*Quercus ilicifolia*, Holly Oak or Scrub Oak (other species of genus on older dunes)

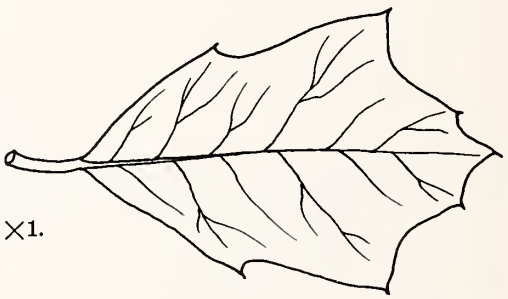


Figure 12.—Leaf ×1.

15 (*13*) Leaves ovate or elliptic, almost broad as long; petioles (leaf stalk) flattened or compressed toward the base of leaf, two glands at base of leaf blade, 20-40 teeth; new branches reddish-brown; leaves trembling in the slightest breeze; trees of transition area between dunes and uplands. .....*Populus tremuloides*, Quaking Aspen

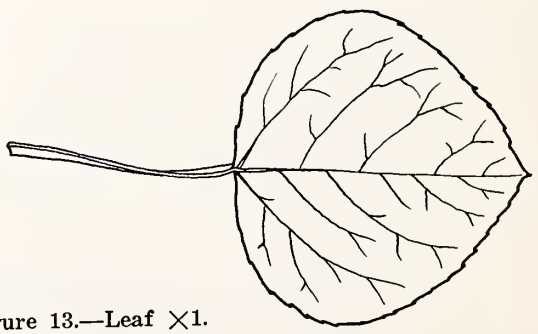


Figure 13.—Leaf ×1.

15 (*13*) Leaves not as above, lacking long flattened petioles. 16

16 (*15*) Trees with stiff horizontal branches; leaves simple, obovate to elliptic and entire; fruit an elongate drupe to 1.5 cm long, purple, on a long peduncle (3-6.5 cm); foliage scarlet early in the fall. .....*Nyssa sylvatica,* Sour Gum

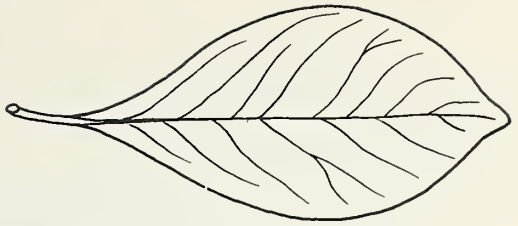


Figure 14.—Leaf ×1.

16 (*15*) Trees with usual branching, leaves simple, serrulate. 17

17 (*16*) Bark of twigs smooth, reddish brown to blackish gray, with conspicuous lenticels (corky spots); bitter almond odor in bark; fruit a drupe (stone fruit). .*Prunus.* A

A (*17*) Small trees, flowers and fruit in racemes. ..... B

A (*17*) Small trees or shrublike growth habit; on dunes and along shores; flowers and fruit solitary or clusters; leaves ovate or oval, acute tip, pubescent beneath when mature; fruit a plumlike drupe; stone pointed at both ends. .....*Prunus maritima,* Beach Plum

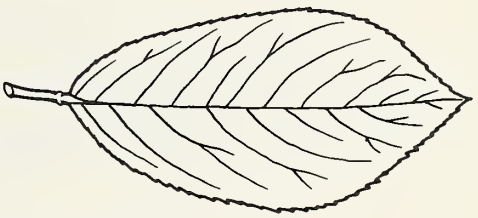


Figure 15.—Leaf ×1.

B (*A*) Sepals deciduous; leaf blade obovate, thin, mostly serrulate with slender teeth, no villose hairs along midrib of the leaf. ...*Prunus virginiana,* Choke Cherry

B (*A*) Sepals persistent; leaf blade elliptic or lanceolate, serrulate with relatively coarse teeth, sometimes villose hairs along prominent midrib of the leaf below. .....*Prunus serotina,* Black Cherry

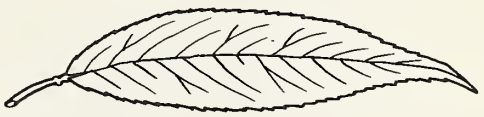


Figure 16.—Leaf × ⅔

17 (*16*) Bark of older twigs grayish, lenticels not conspicuous; leaves elliptic to ovate-oblong, 4-5 cm long; no bitter almond odor in bark; fruit a small pome (apple-like). ....*Amelanchier laevis,* Shadbush (other members of genus may be present)

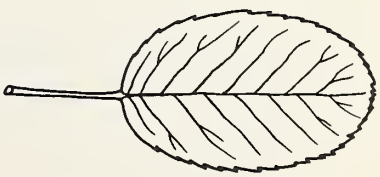


Figure 17.—Leaf ×1.

18 (*11*) Leaves tiny and scalelike, closely imbricated (covering base of leaf above), pubescent, flowers yellow, sessile; low shrubs forming hoary cushions 15-30 cm high on secondary sand dunes and in the hollows between dunes. .....*Hudsonia tomentosa,* Beach Heather, Poverty Grass of Thoreau (*H. ericoides* may occur on dunes)

Figure 18.—Stem, leaves and flowers ×2.

18 (*11*) Leaves not tiny and scalelike. 19

19 (*18*) Shrubs with leaves aromatic when crushed between the fingers. 20

19 (*18*) Shrubs; leaves not aromatic. 21

20 (*19*) Leaves elliptic, oblanceolate or obovate with wax dots beneath; branches whitish gray or drab; clusters of bony globular nuts covered with white or gray wax. .....*Myrica pensylvanica,* Bayberry

Figure 19.—Stem and leaves ×½.

20 (*19*) Leaves linear lanceolate with pinnate dentations (fernlike), hairy on one or both surfaces, wax dots prominent on upper surface of leaf; branches darker grey; bristled dry fruit (nut). .....*Comptonia peregrina,* Sweet Fern

Figure 20.—Leaf ×1.

21 (*19*) Trailing shrubs; bark papery red to ashy and exfoliating; leaves obovate to spatulate, evergreen, leathery; fruit a dull red drupe; forms large mats on sandy surface of back dunes and sea cliffs. .....*Arctostaphylos uva-ursi,* Bearberry

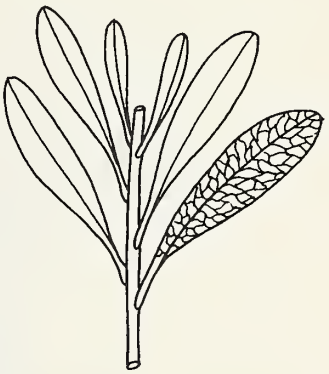


Figure 21.—Stem and leaves ×2.

21 (*19*) Erect shrubs; bark and leaves various; fruit various. 22

22 (*21*) Leaves of stem broadly ovate, 7-18 cm long, 3-lobed, dark green above, lower surface covered with light pubescence; stems woody with large pith (one-half width of stem); large pink flowers, 4-10 cm broad (in some areas flowers white with pink center); fruit a capsule; plants of the brackish fringe of the tidal marshes. .....*Hibiscus palustris,* Marsh Mallow

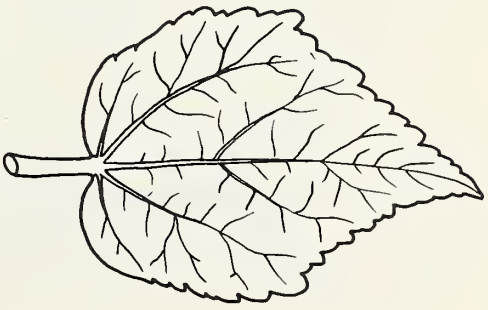


Figure 22.—Leaf × ⅔.

22 (*21*) Leaves of stem small to 4 cm in length, not lobed; stem with pith not visible; flowers small, various colors; fruit various; plants generally of older dunes or hollows of dunes. 23

23 (*22*) Shrubs of transitional part of dunes and in wooded areas; leaves oval to oblong, entire; with shiny resinous dots, black berrylike drupe without a bloom. .....*Gaylussacia baccata,* Black Huckleberry

Figure 23.—Stem and leaves ×1.

23 (*22*) Shrubs growing in low ground; leaves obovate to oblong, serrate, flowers in elongate terminal panicles. .....*Spiraea.* ...A

A (*23*) Leaves light green on both sides; flowers white to pinkish. 1

1 (*A*) Main stem red or purple brown; flower stem glabrate (smooth). .....*S. latifolia,* Meadowsweet

1 (*A*) Main stem yellowish brown; flower stem densely pubescent. .....*S. alba,* Meadowsweet

Figure 24.—Stem and leaves ×1.

A (*23*) Leaves felted beneath with white or tawny hairs; flowers pink. .....*S. tomentosa,* Hardhack or Steeplebush

Figure 25.—Stem and leaves ×1.

24 (*1*) Plants submerged in water at all times, collapse when taken from the water (flowering plants only, exclude algae); flowers may be above the water surface and later withdrawn. 25

24 (*1*) Plants may be submerged only periodically by tidal waters or completely terrestrial. . 27

25 (*24*) Blade of leaf long, flattened, 1.5-6 mm wide and up to a meter long; usually in very soft muddy bottom. .....*Zostera marina*, Eel Grass

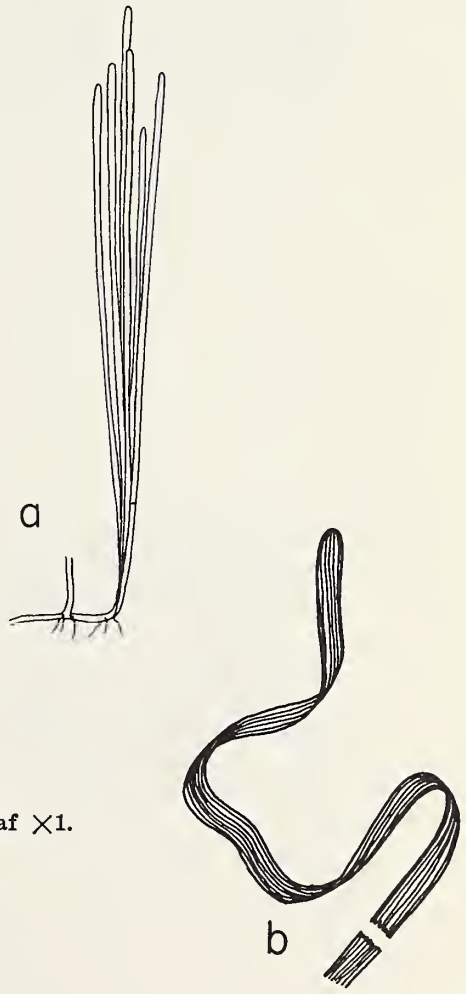


Figure 26.—(a) Habit sketch; (b) terminal portion of leaf ×1.

25 (*24*) Blades of the leaf, threadlike; in quieter water of estuaries, pools in the tidal marsh, and brackish pools back of beaches. 26

26 (*25*) Flower and fruit spike of isolated whorls of sessile flowers and fruits raised above the stipules; fruit with a short beak. .....*Potamogeton pectinatus,* Sago Pond Weed (other species may occur)

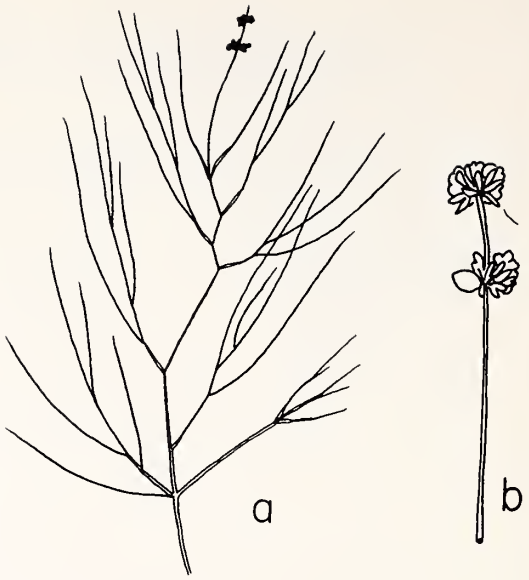


Figure 27.—(a) Habit sketch; (b) stem and flowers ×2.

26 (*25*) Flower spikes enclosed at first in sheathing leaf base; fruit an assymetrical cone-shaped drupe on a long pedicel, 4 to 6 in a cluster, peduncles frequently twisted in a spiral coil, pulling the fruits below the water surface. . . ..*Ruppia maritima,* Widgeon Grass

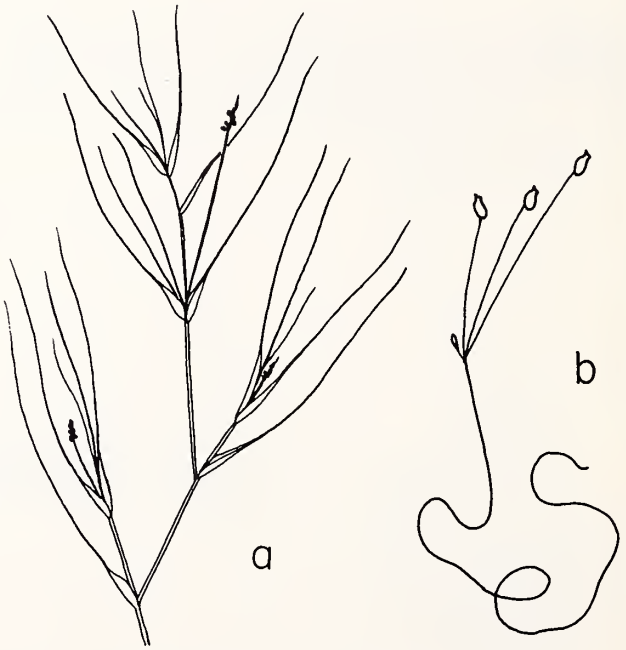


Figure 28.—(a) Habit sketch; (b) peduncle, pedicels and fruits ×1.

27 (*24*) Grasses, sedges or rushes; leaves narrow and sheathing the stem. To determine grasses, sedges, and rushes read the following key characters and determine to which of the three groups your plant belongs. These are difficult groups to identify and only the dominant species found along the marine fringe are included. If doubtful, consult some reference such as *Gray's Manual of Botany* (Fernald, 1950) or Gleason and Cronquist (1963):

A (*27*) Grasses (Gramineae). Stems cylindric, hollow except at the nodes (a few have soft pith); leaves in two ranks on the stem, parallel veined; leaves in two parts, a sheath enveloping the stem but open its full length and a flat blade; at junction of sheath and the blade a membranous or hairy appendage, the ligule (see Plate I), this will be the principal character illustrated to designate the species; fruit a grain. 85

B (*27*) Sedges (Cyperaceae). Stems usually solid and many are triangular (three angled); roots fibrous; leaves in three ranks, when present, sheath closed at the top; infloresence, a spike or cluster at top of the stem, flowers lack petals and sepals, one flower in axile of each imbricated bract (scale) which is usually brown; fruit an achene. 86

C (*27*) Rushes (Juncaceae). Stems pithy or hollow, unbranched; leaves narrowly lanceolate or filiform, in basal clumps (tussocks), or represented by sheaths only; cymose or clustered small greenish or brownish flowers; fruit a capsule. 87

27 (*24*) Plants not grasses, sedges or rushes, leaves usually broader. 28

28 (*27*) Plants extremely succulent (water in tissues) and fleshy, in some cases only the leaves of this type; leaves then are very thick and firm between the fingers; plants of *exposed* areas of beaches, dunes, and tidal marshes (if in doubt, try this choice). 29

28 (*27*) Plants not extremely succulent or fleshy; leaves not thick and firm between the fingers; plants more varied in their habitat, but usually not in extremely exposed areas. 39

29 (*28*) Plants with cylindrical (terete) leaves that look like extensions of the stem. 30

29 (*28*) Plants with broader leaves, not cylindrical, or leaves reduced to scales. 31

30 (*29*) Leaves awl-shaped, alternate, ending in a hairlike prickle, plants difficult to handle because of these stiff points, pubescent, plants usually of beaches. .....*Salsoli kali,* Saltwort

Glabrous or sparingly pubescent, leaves longer and points of leaves not as stiff. .....var. *caroliniana*

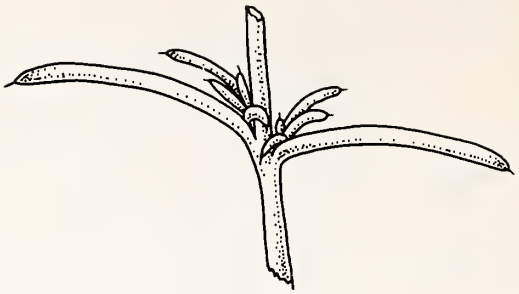


Figure 29.—Stem and node with leaves ×1.

30 (*29*) Leaves linear or slender, cylindric, not bearing a prickle, rounded tips. .....*Suaeda.* ..A

A (*30*) Low plants, branches spreading at base, seeds 2 mm broad. .....*S. maritima,* Sea Blite

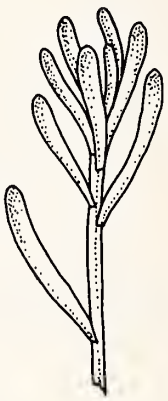


Figure 30.—Stem and leaves ×2.

B (*30*) Erect plants, seeds 1.2-1.5 mm broad. .....*S. linearis,* Sea Blite

31 (*29*) Plants with opposite branching and opposite leaves or scales (opposite branching strong at the base only in *Atriplex*). 32

31 (*29*) Plants with alternate branching and alternate leaves. 34

32 (*31*) Plants with jointed fleshy stems, leaves reduced to tiny scales at each joint (node); flowers in hollows of the thickened upper joints, which form a spike. .....*Salicornia*, Glassworts or Samphire. . .A

A (*32*) Plants perennial, with a stout woody depressed stem (rhizome) forking in the sand; long branched trailing stem; flower spikes at tip of ascending branches; forms extensive perennial mats. .....*S. virginica*

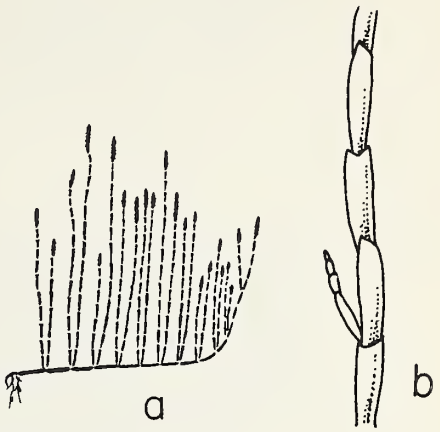


Figure 31.—(a) Habit sketch; (b) stem and scale leaves ×1.

A (*32*) Plants annuals from small root systems; erect plants. ..... B

B (*A*) Scales at the nodes of the stem mucronate-pointed and conspicuous; joints of the flower spike thicker than long. .....*S. bigelovii*

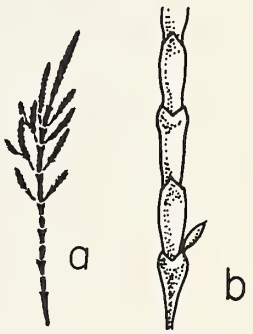


Figure 32.—(a) Habit sketch; (b) stem and scale leaves ×1.

B (*A*) Scale at the nodes blunt, inconspicuous when dried; joints of the flowering spike longer than thick. .....*S. europaea*

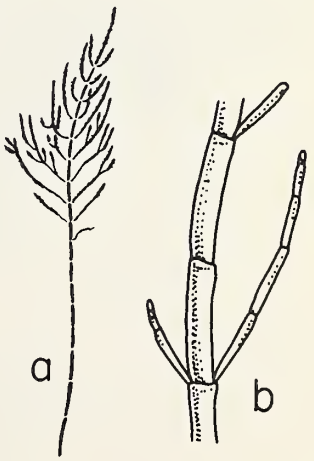


Figure 33.—(a) Habit sketch; (b) stem, branches, and scale leaves ×1.

32 (*31*) Plant stems not as above; leaves not reduced. 33

33 (*32*) Leaves in close tiers, oblong or oblong-ovate, not narrowed at base, resembling a chinese pagoda; plants forming large compact clumps or cushions; plants of the beach. .....*Arenaria peploides* var. *robusta*, Sandwort

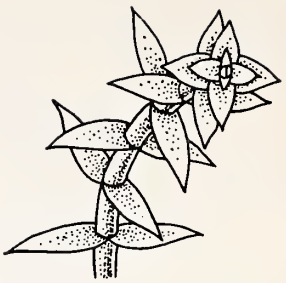


Figure 34.—Apical portion of stem and leaves ×1.

33 (*32*) Leaves not in close tiers; coarse straggling weedy species, both somewhat gray and scurfy, especially young leaves; opposite branching frequently only at base; flowers greenish, both plants usually on the beach. .....*Atriplex*. . .A

A (*33*) Principal leaves hastate or arrow-shaped. .....*A. patula* var. *hastata*, Orach

A (*33*) Leaves broadly oval, stems usually reddish. .....*A. arenaria*, Sand Orach

Figure 35.—Leaf ×1.

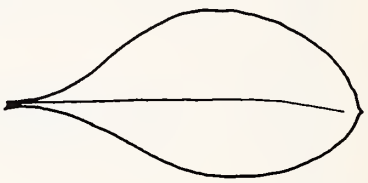


Figure 36.—Leaf ×1½.

34 (*31*) Leaves linear-lanceolate, alternate in a rosette, erect or strongly ascending; flowers from an erect spike from the rosette; plants of the tidal marsh. ....*Plantago*, Seaside Plantain. . .A

A (*34*) Bracts or sepals or both minutely ciliate; flower spike dense with flowers to base; flower stalk exceeding leaves. ..... *P. juncoides*

A (*34*) Bracts and sepals glabrous; flower spike remotely flowered at base; leaves equaling or exceeding the erect flower stalk. .....*P. oliganthos*

Figure 37.—(a) Habit sketch; (b) terminal portion of leaf ×½.

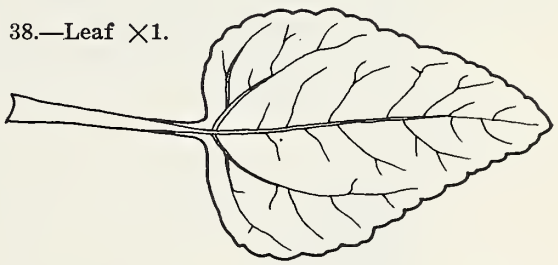
34 (*31*) Leaves not in a rosette; variable shaped leaves on erect stems. 35

35 (*34*) Leaves not entire. 36

35 (*34*) Leaves entire, not toothed or lobed. 38

36 (*35*) Leaves covered with stiff bristles, older leaves cordate, slightly lobed with undulate margins; fruit an olive-shaped bur with recurved spines, plants of beach and dunes. ... .*Xanthium echinatum,* Cocklebur

Figure 38.—Leaf ×1.



36 (*35*) Leaves smooth with no bristles, ovate lanceolate to obovate; pale green plants, no burlike fruits. 37

37 (*36*) Leaves serrate, ovate-lanceolate to ovate or obovate, glabrous or sparingly pubescent below; flat topped clusters of many pink or purple flowers; plants of the tidal marsh. .....*Pluchea purpurascens* var. *succulenta,* Salt Marsh Fleabane

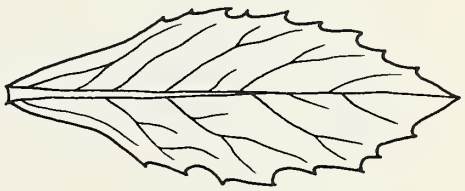


Figure 39.—Leaf ×1.

37 (*36*) Leaves obovate or oblanceolate, sinuate toothed, narrowed to base, young leaves taste of horseradish; fruit a cone-shaped silique; plants of the beaches. .....*Cakile edentula,* Sea Rocket

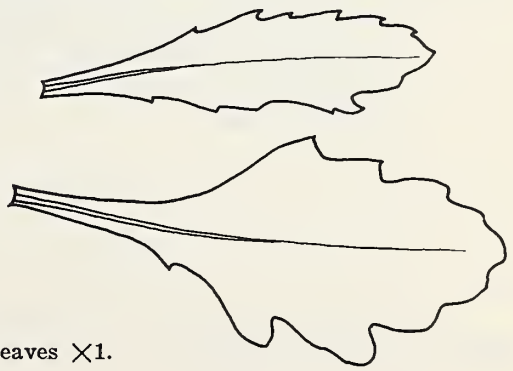


Figure 40.—Leaves ×1.

38 (*35*) Large coarse plants, basal leaves oblanceolate to spatulate-oblong, 1-4 dm long; stem leaves to lanceolate; panicles of yellow flowers late in the summer; plants of beaches, dunes and tidal marshes. ....*Solidago sempervirens*, Seaside Goldenrod

Figure 41.—Stem with leaf and basal leaf × ⅕.

38 (*35*) Smaller, more delicate plants; perennial; leaves narrow-linear; branching subdichotomous; small pink flowers on pedicels arising from axils of the upper leaves; plants of the tidal marsh. .....*Aster tenuifolius*, Salt Marsh Aster

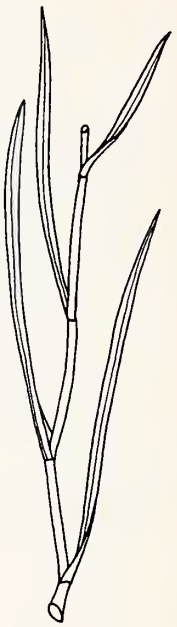


Figure 42.—Stem and leaves ×1.

Another species of the genus present in the area is an annual; it has smaller (purple) flowers than *A. tenuifolius*. .....*A. subulatus*

39 (*28*) A coarse fern with tripinnate frond from an underground creeping and forking rhizome; world wide, growing here on older dunes and sea cliffs. .*Pteridium aquilinum*, Bracken Fern

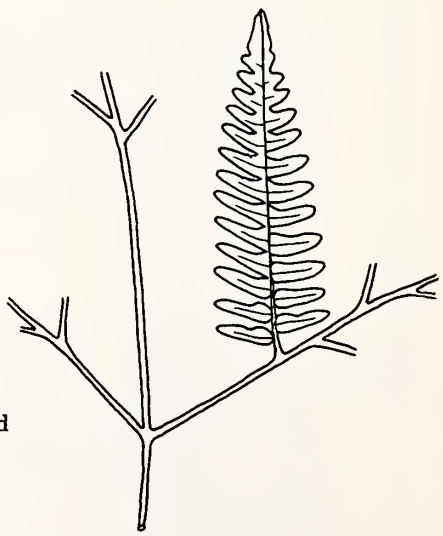


Figure 43.—Portion of frond with pinnule ×½.

39 (*28*) Plants not ferns. 40

40 (*39*) Plants with opposite leaves and branches. 41

40 (*39*) Plants with alternate leaves and branches. 49

41 (*40*) Low creeping plants growing flat on the substrate. 42

41 (*40*) Erect plants, not flat on the substrate. 43

42 (*41*) Spatulate-shaped leaves, usually in whorls at the nodes; one-flowered pedicels form an umbel at the nodes; plants usually weeds of waste places but growing on the beach. .... *Molluga verticillata,* Carpet Weed

Figure 44.—Stem and node with leaves and flower umbel ×2.

42 (*41*) Oblong linear to oblong lanceolate leaves two at each node; milky juice; flowers in fork of leaves; reddish color on leaves and stem; plants of beach and the dune hollows. ....*Euphorbia polygonifolia,* Seaside Spurge

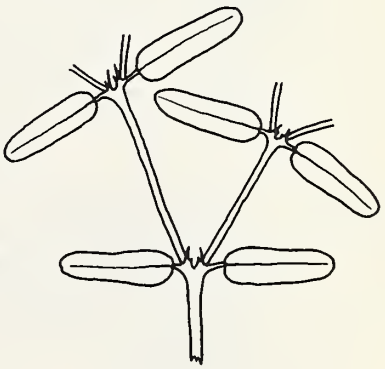


Figure 45.—Stem and leaf nodes ×2.

43 (*41*) Erect plants with a square stem. 44

43 (*41*) Erect plants with a terete or flattish stem. 47

44 (*43*) Leaves linear, entire, primary ones 1.5-3 cm long, rough above, scattered short white hairs; racemes 2-10 flowered, purple; fruit a subglobose capsule, plants of wet areas back of dunes and edges of the tidal marsh. ..... *Gerardia maritima,* Seaside Gerardia

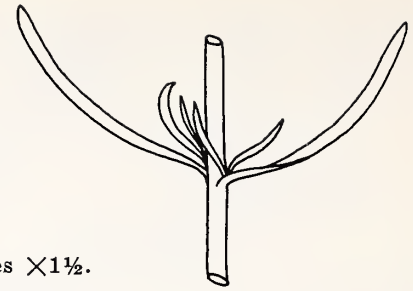


Figure 46.—Stem and node with leaves ×1½.

44 (*43*) Leaves lanceolate. 45

45 (*44*) Leaves entire, crowded on stem, cordate clasping at base; flowers regular in long terminal racemes, magenta; plants of the freshwater marsh border or brackish marsh. ....*Lythrum salicaria,* Spiked Loosestrife

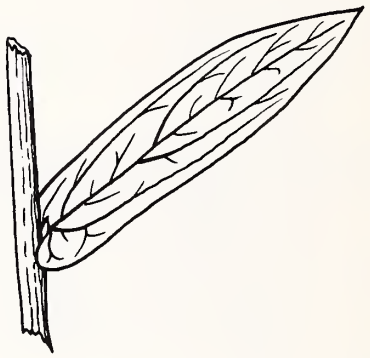


Figure 47.—Stem and leaf ×1.

45 (*44*) Leaves not entire. 46

46 (*45*) Leaves lanceolate to narrowly ovate, merely serrate on edges; flowers purplish, irregular, deeply cleft into two parts; in terminal racemes. .....*Teucrium canadense,* Wood Sage

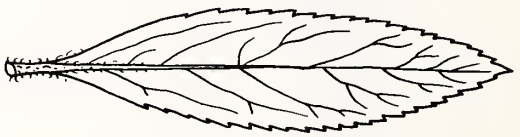


Figure 48.—Leaf ×1.

46 (*45*) Leaves broadly lanceolate to narrowly ovate, serrate-dentate; flowers whitish, small, regular in whorls at the nodes, plant of dunes and marsh border. .....*Lycopus rubellus,* Bugleweed (look for other species)

Figure 49.—Leaf ×1.

47 (*43*) Low, weedy, much branched annuals with awl-shaped or linear leaves. 48

47 (43) Larger erect plants with clasping linear stem leaves; flowers in few clusters at tip of branches, petals roseate; plants of upland border of marsh and dunes. .....*Dianthus armeria*, Deptford Pink

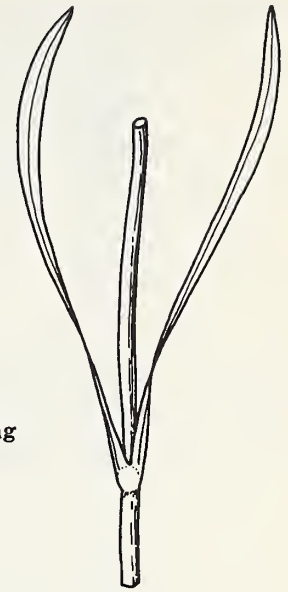


Figure 50.—Stem and clasping leaves ×1.

Figure 51.—Stem and leaves ×3.

48 (*47*) Leaves broad based tapering to a fine point (awl-shaped), to 1 cm long, no stipules; flowers greenish, sessile in fork of leaves; on waste places, roadsides, beaches. .....*Scleranthus annuus*, Knawel

48 (*47*) Leaves filiform from base to tip, mostly longer than 1 cm, large triangular stipules present; flowers on pedicels to 10 mm long, from axils of leaves. .....*Spergularia marina*, Sand Spurrey (*S. rubra* may also be found)

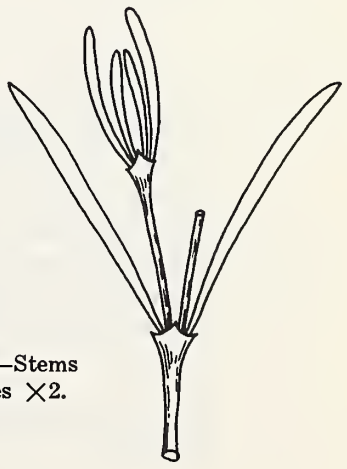


Figure 52.—Stems and leaves ×2.

49 (*40*) Plants with compound leaves. 50

49 (*40*) Plants with simple leaves. 54

(*Note:* Be careful not to include here as compound, simple leaved plants with deeply cut or filiform divisions; example, Yarrow, Figure 68.)

50 (*49*) Plants with pinnately compound leaves. 51

50 (*49*) Plants with palmately compound, or trifoliate, leaves. 52

51 (*50*) Leaves with large stipules at nodal attachment to stem, frequently a tendril replaces a leaflet; flowers pealike, purple or rarely white; fruit a pod or legume; plants of the dunes and beach. .....*Lathyrus japonicus,* Beach Pea

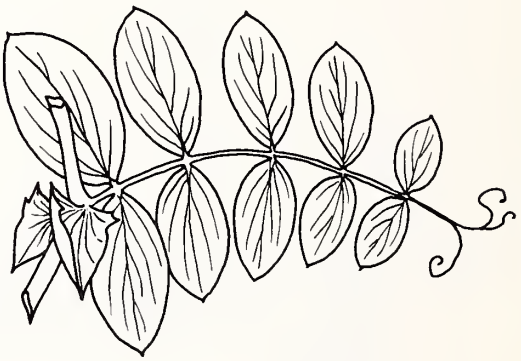


Figure 53.—Stem, stipules and leaf ×½.

51 (*50*) Leaves from basal stem or stolon, purplish at base of leaf and flower stems; leaves densely whitish pubescent below, dark green above; flowers like a buttercup, yellow; plants of upper slope of tidal marsh. .....*Potentilla egedei* var. *groenlandica,* Silver Weed

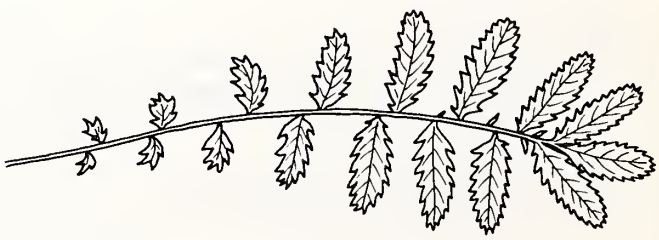


Figure 54.—Compound leaf ×½.

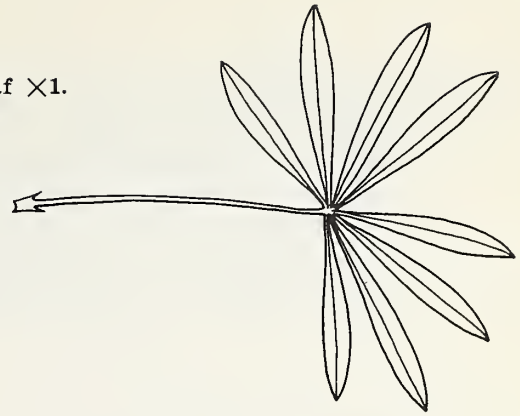


Figure 55.—Leaf ×1.

52 (*50*) Five to eleven oblanceolate leaflets; pealike purple flowers; fruit a pod or legume; plants of dune border or sea cliff. .....*Lupinus perennis*, Wild Lupine

52 (*50*) Plants with trifoliate leaves, each leaflet may be divided into three segments. 53

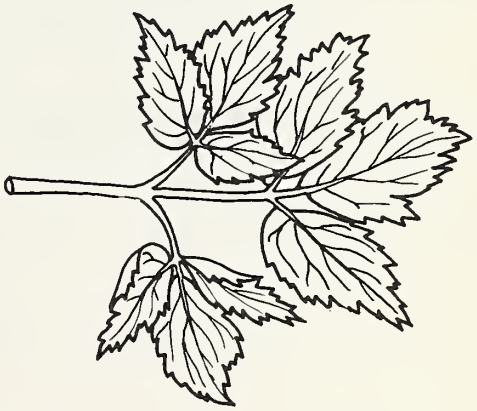


Figure 56.—Leaf ×¼.

53 (*52*) Plants 3-6 dm tall from a large root; three leaflets, each of which is divided into three segments (biternate); flowers in umbels; fruit of two carpels, dividing down the middle when ripe; when crushed faint parsleylike odor; plants of beach and edge of tidal marsh. .....*Ligusticum scothicum*, Scotch Lovage

Figure 57.—Leaf ×2.

53 (*52*) Plants 2-3 ft tall, smooth and slender; three rounded, wedge-obovate leaflets, almost sessile; flowers yellow, pealike; fruit a legume; plants turn black on being dried; back of dunes and on sea cliffs. .....*Baptisia tinctoria*, Wild Indigo

54 (*49*) Plants twining or creeping over the substrate or on other plants; leaves cordate or deltoid-ovate, long petioled; large funnel-shaped flowers, white to roseate; plants of beaches and waste places. .....*Convolvulus sepium*, Hedge Bindweed or Wild Morning Glory

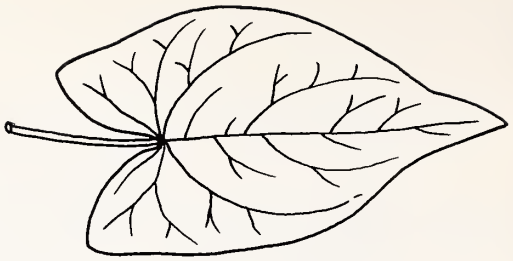


Figure 58.—Leaf ×1.

54 (*49*) Plants not creeping. 55

55 (*54*) Plants with cluster of basal leaves, erect flowering stalk that arises from basal rosette. 56

55 (*54*) Plants not as above. 60

56 (*55*) Rushlike slender leaves sheathing the base of a narrow and jointless flower scape, up to 11.5 dm tall; fruit longer than thick; plants of brackish and tidal marsh. .....*Triglochin maritima*, Arrow-Grass

Figure 59.—Habit sketch.

56 (*55*) Leaves not rushlike, broader, various shapes. 57

57 (*56*) Leaves hastate, two basel lobes somewhat divergent; flowering stem to 5 dm high, slender, reddish raceme of flowers, nodding on short stems (pedicels); common weed of beach, dunes, and waste places. .....*Rumex acetosella,* Sheep Sorrel

Figure 60.—Leaf ×1.

57 (*56*) Leaves not hastate, longer. 58

58 (*57*) Caudex (a basal persistent stem of an herb) woody and thick, leaves spatulate, entire, sometimes tinged with red at the tips; flowers tiny, lavender on a much branched leafless stem (scape), panicled; plants of tidal marsh and edge of the dunes. .....*Limonium carolinianum,* Sea Lavender

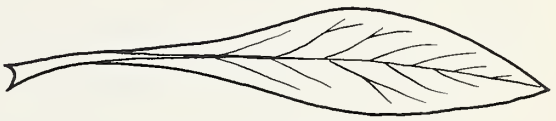


Figure 61.—Leaf ×½.

A plant transitional to *L. carolinianum,* with a more compact flower panicle, more common north of Cape Cod and northward. .....*L. nashii*

58 (*57*) No distinct thick and woody caudex. 59

59 (*58*) Leaves linear, pinnate, rough to the touch with bristly hairs, main veins whitish; flowers yellow, resembling large dandelions at top of branched stalks; fruits an achene with white pappus (hairs); plants of sea cliffs and waste places. .....*Hypochoeris radicata,* Cat's Ear

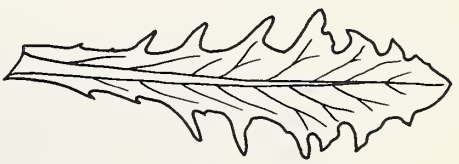


Figure 62.—Leaf ×½.

59 (*58*) Leaves spatulate, narrow to stem, slightly undulate border, veins reddish; flowers yellow, resembling small dandelions, in open clusters at top of an almost leafless stalk; fruit an achene with pappus; plants of older dunes and sea cliffs. .....*Hieracium venosum,* Hawkweed, Rattlesnake Weed

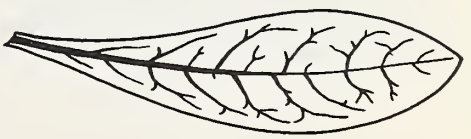


Figure 63.—Leaf ×¾.

60 (*55*) Plants forming compact cushions 1.5-3 dm high on sand dunes; somewhat woody at base; leaves tiny, scalelike, closely imbricated (covering base of leaf above), pubescent; flowers bright yellow, sessile; plants of secondary dunes and hollows between dunes. .....*Hudsonia tomentosa*, Poverty Grass of Thoreau, Dune Heather (*H. ericoides* on some dunes)

Figure 64.—Stem, leaves, and flowers ×2.

60 (*55*) Plants not forming compact hoary cushions on dunes. 61

61 (*60*) Plants with simple lobed leaves. 62

61 (*60*) Plants with simple leaves, not lobed, linear-lanceolate to deltoid (triangular). 69

62 (*61*) Plants with palmately lobed leaves, broadly ovate, three-lobed, lower surface covered with light pubescence; stems woody with large pith (middle one-half of stem); large pink flowers, to 10 cm broad; fruit a capsule; plants of brackish fringe of the tidal marsh. .....*Hibiscus palustris*, Marsh Mallow

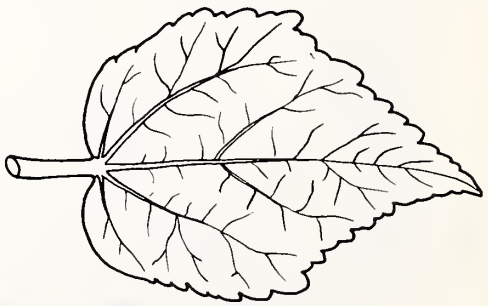


Figure 65.—Leaf × ⅔.

62 (*61*) Plants with pinnately lobed leaves, not cut to the midrib. 63

63 (*62*) Plants with filiform (threadlike) segments of the leaf. 64

63 (*62*) Plants with leaf broader, segments or lobes not threadlike. 65

64 (*63*) Coarse plants of the dunes with huge tap root; large cluster of basal leaves with filiform segments to 10 cm long, with expanded petiole at the nodal joint; leaves of flower stem similar; large panicle of green to bronze flowers on stem arising from base. ..... *Artemisia caudata*, Wormwood

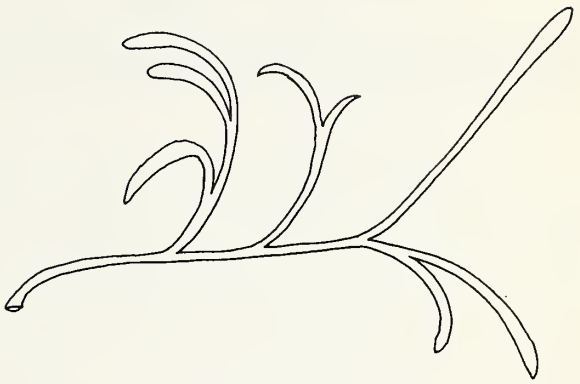


Figure 66.—Leaf ×1.

64 (*63*) More delicate plants of marshes, with fibrous roots; stem branching subdichotomous, leaves delicately filiform to 5 cm long; flowers white, small, in terminal umbels. .....*Ptilimnium capillaceum*, Mock Bishop's Weed

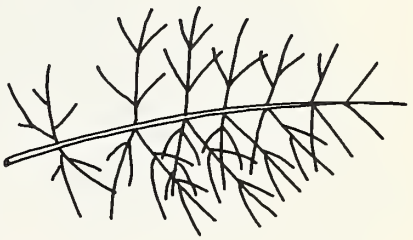


Figure 67.—Leaf with filiform divisions ×1.

65 (*63*) Leaves 2.5-15 cm long, bipinnately parted into fine divisions like a fern leaf, odor strong and disagreeable when leaf is crushed; flowers white (rarely pink) in flat topped crowded corymbs; common plant on beaches and waste places. ....*Achillea millefolium*, Yarrow

Figure 68.—Leaf ×1.

65 (*63*) Leaves not as above. 66

66 (*65*) Plants covered with thick wooly hairs; growing from extensive creeping and forking rhizomes, forming extensive clumps; leaves with broad petioles, obovate, bluntly lobed; flowers on an erect stem, yellow but not showy; plants of the beaches and frontal dunes. .....*Artemisia stelleriana,* Silver King, Dusty Miller

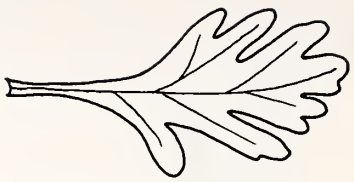


Figure 69.—Leaf ×½.

66 (*65*) Plants not thickly covered with hairs; beaches and waste places. 67

67 (*66*) Leaves pinnately lobed with soft spiny teeth, clasping cordate base with basal auricles, terminal half of the leaf much larger than lateral lobes; flowers yellow; fruit an achene with a white pappus; on beaches and waste places. ... .*Sonchus oleraceus,* Common Sow Thistle

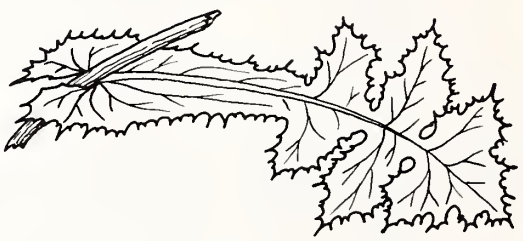


Figure 70.—Stem and leaf ×½.

67 (*66*) Leaves pinnately lobed without spiny teeth. 68

68 (*67*) Leaves grayish-green, lower leaves pinnate, upper leaves deeply pinnately lobed, toothed, fine hairs beneath, hairs thick along midrib; saffron colored juice; yellow flowers; capsules long and linear to 20 cm dividing into two halves when ripe; plants of the beach. . . .*Glaucium flavum,* Sea Poppy

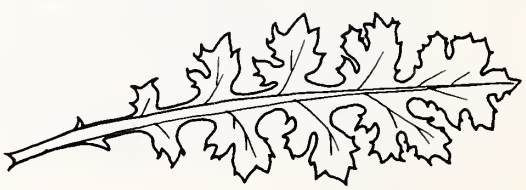


Figure 71.—Leaf × ⅔.

68 (*67*) Leaves grass-green or gray-green, pinnate to tripinnately lobed, both opposite and alternate, foliage resembling that of *Artemisia stelleriana* (Fig. 67), but lacks the wooly hairs; flowers in greenish terminal clusters; upper beaches and waste places. .....*Ambrosia artemisiifolia*, Ragweed

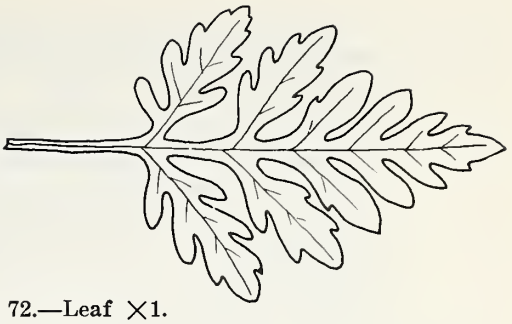


Figure 72.—Leaf ×1.

69 (*61*) Leaves broad triangular to oval. 70

69 (*61*) Leaves linear or lanceolate. 73

70 (*69*) Large vinelike plants with thorns; usually creeping over other vegetation, may form impenetrable thickets; leaves ovate or oval with three prominent main veins, tendrils at the base of some leaves; flowers in loose umbels; berries blue; plants of old dunes and sea cliffs. .... *Smilax rotundifolia*, Common Greenbriar (other species may be found)

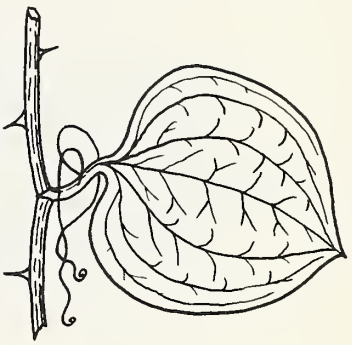


Figure 73.—Stem and leaf ×½.

70 (*69*) Not vinelike, no thorns. 71

71 (*70*) Plants with light green, ovate-deltoid, serrate dentate or serrate leaves, very mealy especially below; flowers greenish in paniculate spikes; long tap roots; on beaches but a common weed of waste places. .....*Chenopodium album*, Lamb's Quarters

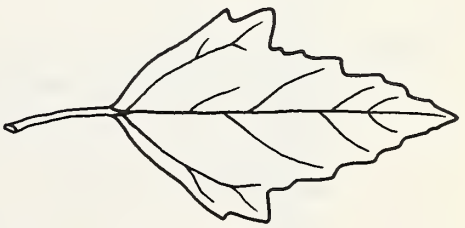


Figure 74.—Leaf ×1½.

71 (*70*) Plants with darker green leaves, no mealy spots on leaves; flowers variable. 72

72 (*71*) Large coarse plants with thick spongy stems; leaves large ovate to deltoid, sinuate-toothed or angled; flowers white, large and funnel-shaped; fruit a prickly capsule; an ill-scented and poisonous weed (but not to the touch); upper beaches and on piles of dead trash. .....*Datura stramonium*, Jimson Weed

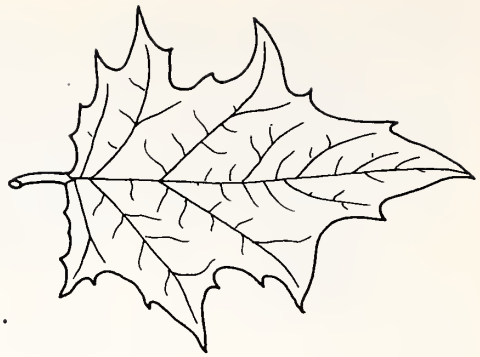


Figure 75.—Leaf ×½.

72 (*71*) Plants not as coarse, and stems firm; leaves ovate, entire, or sinuate, and acuminate at tips, without auricled or lobed base; flowers in umbels, white; berry black, poisonous in the unripe condition; on beaches and dunes. .....*Solanum nigrum*, Black Nightshade

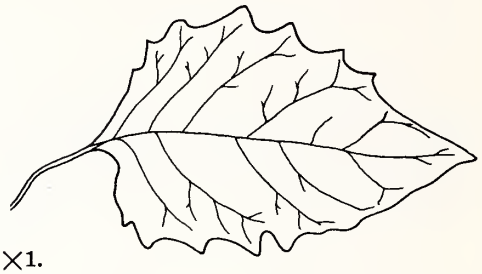


Figure 76a.—Leaf ×1.

A vinelike plant of the same genus; leaves entire but auricled or lobed at the base; flowers in cymes, violet; berry red and poisonous. .....*S. dulcamara*. Bittersweet, Nightshade

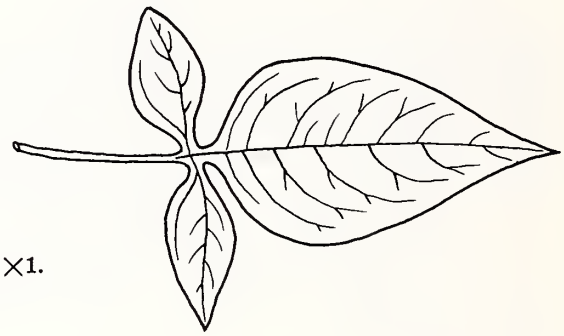


Figure 76b.—Leaf ×1.

73 (*69*) Leaves lanceolate, with 7-12 parallel veins; terminal raceme of flowers; berries at first greenish, later ruby-red; plants in the hollows of older dunes. .... *Smilacina stellata*, False Solomon's Seal

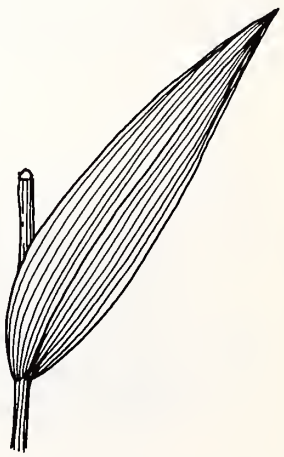


Figure 77.—Stem and attached leaf ×1.

73 (*69*) Leaves not parallel veined. 74

74 (*73*) Leaves showing irregular serrations or slight undulating border, or even slightly pinnatifid (pinnately cleft). 75

74 (*73*) Leaves entire. 79

75 (*74*) Leaves long petioled, lanceolate to lance-ovate, irregularly toothed; terminal raceme of deep red flowers; plants of the freshwater border of tidal marshes. .....*Lobelia cardinalis*, Cardinal Flower

Figure 78.—Leaf ×½.

75 (*74*) Leaves not as above. 76

76 (*75*) Stems with scattered silky hair or dense wooly hair. 77

76 (*75*) Stems smooth, no hairs. 78

77 (*76*) Stem with scattered silky hair; leaves narrowly to broadly lanceolate, border undulate, crowded on stem, passing into bracts below the flowers, short appressed hairs more abundant on under surface, leaves frequently tipped with red; flowers yellow opening late afternoon; fruit a conical capsule to 3 cm long, crowded on terminal portion of stem; plants of beaches and dunes. .....*Oenothera parviflora*, Evening-Primrose (other species of genus may occur, *O. humifusa* in New Jersey and Delaware)

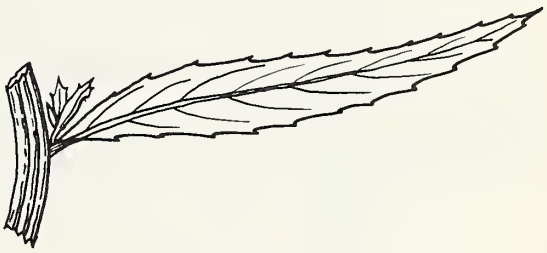


Figure 79.—Stem and leaf ×½.

77 (*76*) Stems densely covered with white wooly hair, leaves narrowly lanceolate, undulate borders, sessile, dense wooly hair on the undersurface; flowers in crowded terminal corymbs, pearly white and drying like straw flowers; plants of back dunes and protected areas. .... *Gnaphalium obtusifolium*, Common Everlasting, Cudweed

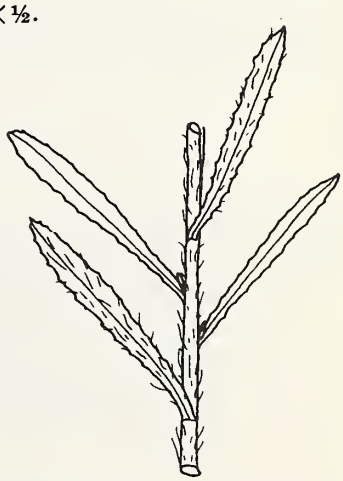


Figure 80.—Stem and leaves ×1.

78 (*76*) Lower leaves long, petioled and spatulate with pinnate serrations, upper stem leaves sessile and deeply pinnately toothed; flowers a daisy; plants of sea cliffs and dunes (also roadsides, etc.). . . . . *Chrysanthemum leucanthemum*, Ox-Eye Daisy

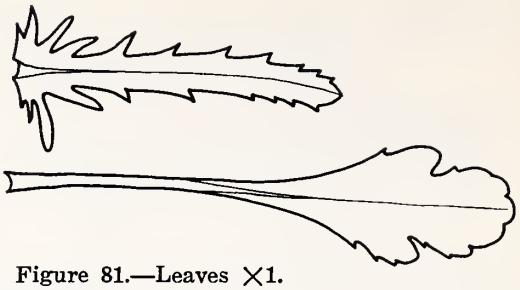


Figure 81.—Leaves ×1.

78 (*76*) Lower leaves almost sessile, pinnately toothed, upper stem leaves linear; racemes of small white flowers, followed by larger oval-shaped siliques; plants of dunes and waste places. . . . . *Lepidium virginicum*, Peppergrass

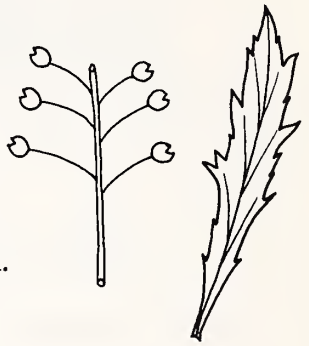


Figure 82.—Siliques and leaf ×1.

79 (*74*) Plants with conspicuous stipules at each node in form of a sheath (ocreae) subtending the leaf. 80

79 (*74*) Plants lacking conspicuous stipules at nodes. 81

80 (*79*) Stipules ending in points; leaves whitish gray or green linear-oblong, rugose on upper surface; flowers white; clusters growing from stipules at nodes; fruit a lustrous black achene, exserted from floral envelope; plants of sea beaches and dune hollows. . . . . *Polygonum glaucum*, Seabeach Knotweed

Figure 83.—Stem and node with stipule. Leaf and flower ×2½.

80 (*79*) Stipules, tubular, truncate and clasping stem, giving the appearance of a jointed stem; leaves linear-filiform; flowers rose or white in slender terminal racemes; fruit an achene; plants of the back dunes and cobble beaches. .....*Polygonella articulata,* Jointweed

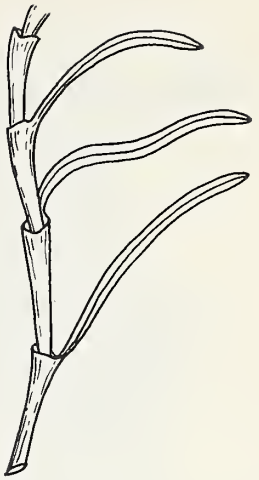


Figure 84.—Stem, stipules and leaves ×4.

81 (*79*) Plants with many erect stems from a biennial or perennial woody tap root. 82

81 (*79*) Plants with a single or a few erect stems from a tap root or fibrous root. 83

82 (*81*) Very leafy stems from 1-4.5 dm high, smooth, no pubescence; leaves obovate to elliptic and only 2 cm long; loose terminal racemes 2-12 cm long, rose-pink to rose-purple flowers, minute cleistogamous (closed colorless, self fertile flowers) flowers and capsules in one-seeded racemes at base of plant after showy flowers; plants of sea cliffs and bask dunes. . .*Polygala polygama* var. *obtusa,* Milkwort

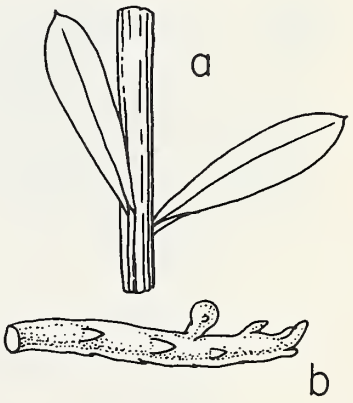


Figure 85.—(a) Stem and leaves; (b) raceme and cleistogamous flowers ×3.

82 (*81*) Leafy stems to 1 dm tall, densely covered with white hairs; leaves lanceolate to elliptic, three to four times as long as broad, whorled on stem or alternate in flower panicle, starting about middle of stem; old flower stalks persisting into next year; plants of dunes (*Hudsonia* zone). .....*Lechea maritima,* Seaside Pinweed

Figure 86.—Stem and whorl of leaves ×1.

83 (*81*) Very slender annual or biennial with trailing basal offshoots; narrowly linear leaves, scattered widely on flowering stalk; very loose raceme of blue-violet flowers; fruit a capsule; a plant of late spring and early summer and disappearing after seeds are formed; plants of older protected dunes, sometimes near beaches and waste places. ....*Linaria canadensis*, Toadflax

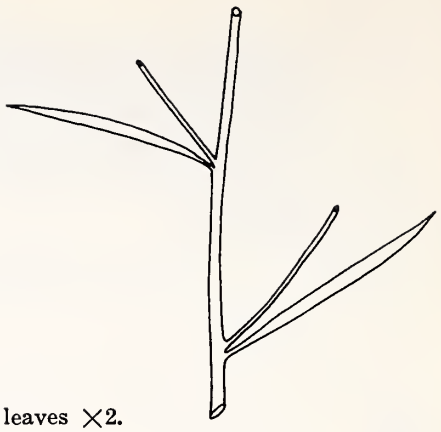


Figure 87.—Stem and leaves ×2.

83 (*81*) Coarser plants without trailing basal shoots. 84

84 (*83*) Erect plants, usually with a single hairless stem, branching above; leaves linear on main stem to 5 cm long, 2 cm long on branches with a single vein; flowers in flat topped corymbs, yellow; plants of margins of brackish ponds and marshes. .....*Solidago tenuifolia*, Goldenrod

A much coarser plant growing in the same habitat; leaves lanceolate with three to five veins; much branched corymbose flower heads. .....*S. graminifolia*, Grass Leaved Goldenrod

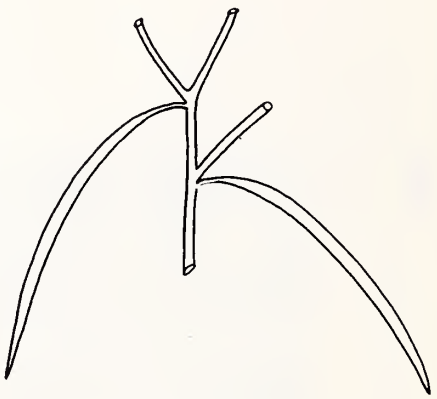


Figure 88.—Stem and leaves ×1.

84 (*83*) Erect plants frequently with several stems from base and the branching lower on stem; linear leaves to 6 cm, smaller leaves to 3 cm; flowers in terminal clusters, yellow, resembling an aster; plants of dunes frequently in the *Hudsonia* zone (also sandy roadsides). .....*Chrysopsis falcata*, Golden Aster

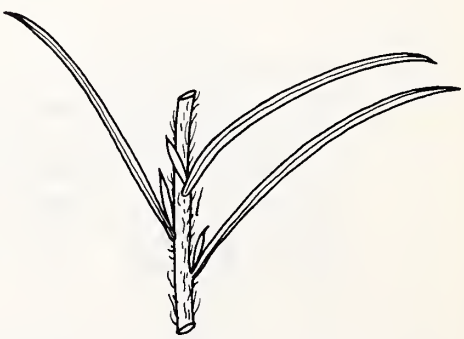


Figure 89.—Stem and leaves ×1.

85 (*27*) Gramineae

The character illustrated for each of the common species of grasses is the ligule. This is a membranous or hair structure found where the blade of the leaf joins the sheath (see Plate I). The grasses are arranged below in their typical habitat:

I. Dunes

Ammophila breviligulata, Dune, Marram, or Beach Grass

A very coarse grass characteristic of frontal dunes and hollows. It also occurs at edge of and on the eroded portions of sea cliffs and on beaches. Ligule membranous to 3 mm long. Flowering spike linear, cylindric and completely covered with flowers.

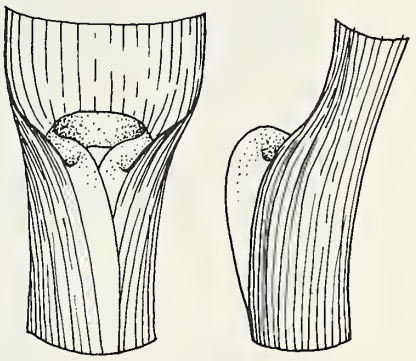


Figure 90.—Ligule ×4.

Festuca rubra, Red Fescue Grass

A less coarse grass of the back dunes, sometimes scattered in the *Ammophila* zone. Sheath brownish and blades stiff and setaceous, ligule membranous. Growing from a creeping rootstock. Less frequent in tidal marsh, in *Spartina patens* and *Juncus gerardi* zones. Flowers in a loose panicle.

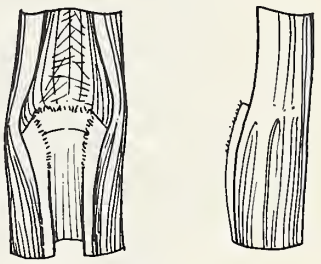


Figure 91.—Ligule ×10

Deschampia flexuosa, Common Hairgrass

Numerous inward rolled threadlike basal leaves 5-20 cm long, 0.4 mm wide; stem slender and nearly naked of leaves; ligule membranous, 2 mm; flower panicle very loose, nodding with pedicels blackish and threadlike. Plants of the hollow of dunes and top of sea cliffs.

Figure 92.—Ligule ×15.

Spartina alterniflora, Salt Marsh Cord Grass

A large coarse grass found at the margin of tidal marshes and along all creeks and pools in the marsh. Ligule a fringe of hairs, base fused and membranous. Blade of 18 mm wide. A dwarf form occurs in the lower portion of the *S. patens* zone. Growing from a rhizome covered with white papery scales; flowers in comblike cluster, tight against the stem.

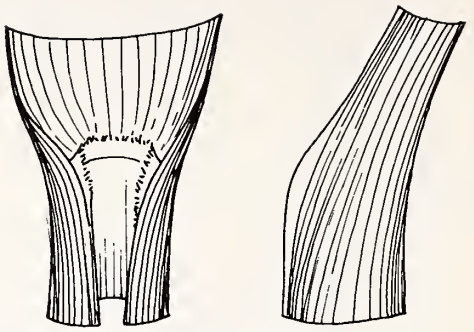


Figure 93.—Ligule ×4.

Spartina patens, Salt Marsh Hay

A slender grass forming almost pure stands on lower slope of the marsh, also on sea beaches. In late summer and fall the growth habit shows a "cowlick" formation. Basal leaves filiform (threadlike), upper leaves to 1 dm long, ligule a fringe of hairs; flower two or more comblike spikes forming an open panicle, purplish, flowers unilateral on spike.

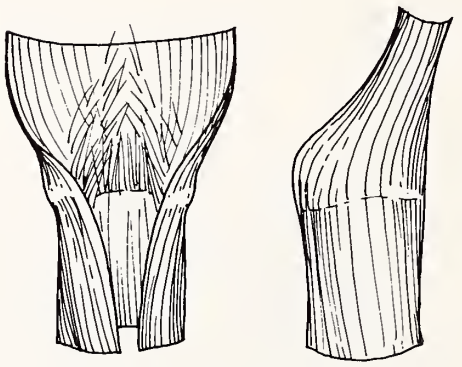


Figure 94.—Ligule ×4.

Spartina pectinata, Fresh Water Cord Grass

A tall coarse grass found growing around the upland edge of the tidal marsh and on upper reaches of the creeks in low salinity. Leaf margins and glume keel strongly scabrous, harsh to run finger down edge. Growth from a large scaly rhizome. Ligule a fringe of hairs to 2 mm long; blade 6-10 mm wide. Flower stalks with many panicles of comblike spikes, long awns on flowers of spikes.

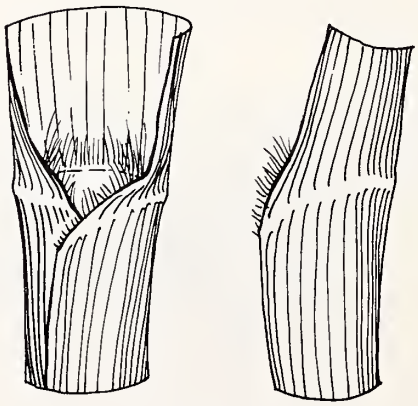


Figure 95.—Ligule ×3.

Phragmites communis, Reed Grass

Large erect grass to 6 m tall, from long creeping rhizomes; ligule a fringe of hairs, some to 6 mm long. Exceedingly feathery flower panicle with long silky hair, tawny or purplish in color, grass of brackish to fresh water areas of marsh, sometimes on low dunes.

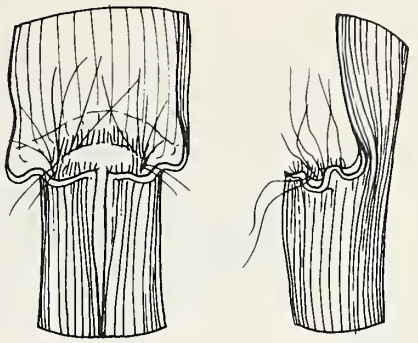


Figure 96.—Ligule ×½.

Distichlis spicata, Spike Grass

Grass of the *Spartina patens* zone, sometimes in pure stands. Leaves 2-3 mm wide and a compact, subcylindrical panicle of flowers, distinct from the *Spartina* spike. Ligule membranous. Creeping rhizome frequently invades bare areas.

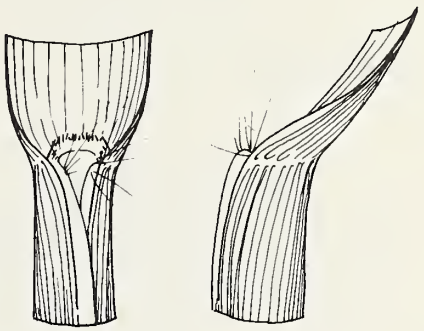


Figure 97.—Ligule ×4.

Agrostis alba var. *palustris*, Redtop Grass

Delicate grass scattered in *Spartina patens* zone. Densely matted, partly decumbent. Creeping rhizome. Blade of leaf 4-10 mm wide, ligule membranous to 3-7 mm long. Panicle of flowers purplish-bronze, becomes whitish in fruit.

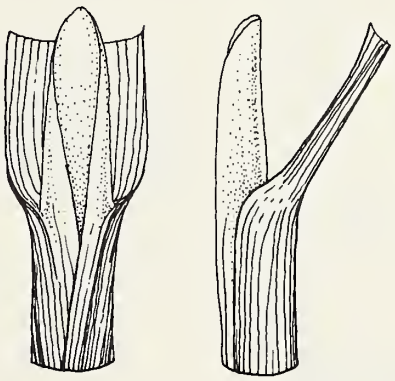


Figure 98.—Ligule ×5.

Elymus virginicus var. *halophilus*, Terrell Grass

Erect stiff grass of the upland edge of tidal marsh or between it and beach or dunes. Blade of leaf 5-14 mm wide, ligule membranous. Flowering spike resembles wheat but seems two-ranked and flat.

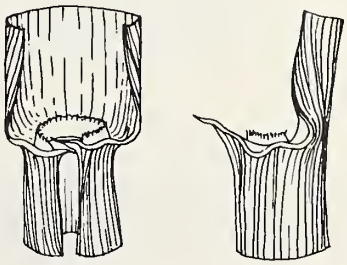


Figure 99.—Ligule ×4.

Panicum virgatum, Switch Grass

Large coarse grass in thick hummocks or tussocks. Blade 10-15 mm wide, ligule a fringe of hairs. Loose widely spreading flower panicle. Grass in the transition zone of the marsh border, sometimes at the edge of beaches and dunes.

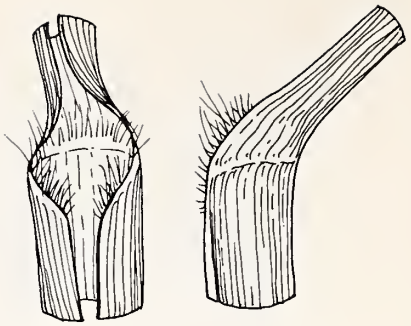


Figure 100.—Ligule ×2.

III. Beach

Bromus tectorum, Cheat

An annual grass, growing early in the season and becoming brown and dead by midsummer. Blade 5-8 mm wide, ligule membranous 1.5-3 mm long, rounded to acute. Very loose panicle, recurving flexuous branches with long awns (bristles) resembling oats, often purple in color.

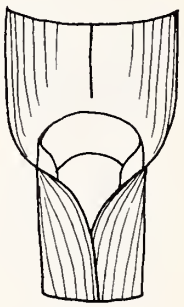


Figure 101.—Ligule ×2.

86 (*27*) Cyperaceae

I. Dunes

Cyperus grayii, Gray's Sedge

Rhizomes with hard cormlike swollen branches; stems wiry, filiform, leaves gray-green to 3 dm tall; flowers in nearly spherical heads on 3-14 stiff capillary smooth stems forming an umbel; in sandy hollows of dunes. It is suggested that a more inclusive manual be referred to for verification.

Cyperus spp.

Other species of *Cyperus* may occur in the dunes or at the edge of dunes. Identification should be made by the use of one of the manuals (Fernald, 1950; Gleason and Cronquist, 1963) or referred to a botanical taxonomist.

Scirpus americanus, Three-Square Rush

Rhizomes stout and hard, dark brown; upper sheath concave, but not notched, bearing an elongate, linear, sharp, pointed blade; spikelets many in sessile clusters, reddish-brown; involucre appears to be continuation of stem, long to 15 cm, acute; plants of brackish to freshwater borders of marshes, usually in almost pure stands.

Figure 102.—Stem, flower cluster and involucre ×2.

Scirpus paludosus var. *atlanticus,* Bayonet Grass

Growing from a cormlike enlargement of the rhizome; stems three-angled; leaves borne chiefly or wholly below the middle of the stem; two or three involucral bracts; in borders of brackish ponds and on tidal marshes.

Figure 103.—Habit sketch × 1/10.

Scirpus torreyi, Torrey's Rush

Rhizome flaccid, brownish; upper sheath readily splitting, leaves triangular channeled with obliquely rounded tips; spikelets in sessile clusters, oblong-lanceolate, reddish-brown; involucre appears to be continuation of stem; 3-5 cm long; plants along brackish to freshwater margins of ponds and marshes.

Eleocharis spp., Spike Rush

Thin wiry stems forming tufted clusters from a creeping rhizome, leafless, but basal part of stem sheathed; many of the stems topped with a conelike brown or reddish-brown flower spikelet; wet margins of brackish ponds and marshes. Several species, but identification cannot be made until fruits (achenes) are ripe. For species identification reference should be made to one or other of the manuals suggested.

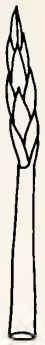


Figure 104.—Stem and flower spikelets ×3.

Eleocharis parvula

A small spike rush, 1-7 cm high, growing in muddy areas of tidal marshes and on wet saline or brackish shores. Plants tufted with threadlike leaves, shallow fibrous roots.

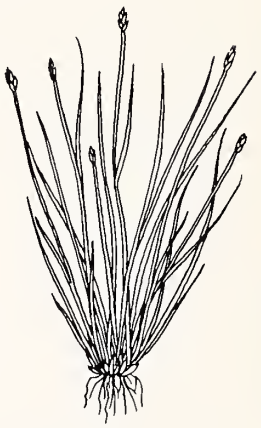


Figure 105.—Habit sketch ×1.

87 (*27*) Juncaceae

I. Tidal Marsh

Juncus gerardi, Black Grass

Wiry erect herbs resembling grasses or rushes, from slender rhizomes growing horizontally in the marsh; leaf sheath extending about one-third of the way up the stem, leaf blade stiff, ascending scarcely flattened; stem ends in a cyme of brown flowers (see Fig. 106); achenes protruding from floral envelope in late summer giving a dark brown aspect to the marsh zone; almost pure stands growing at the upper, landward edge of the tidal marsh.

Figure 106.—Flower cyme ×1.

Juncus balticus

Erect herbs with slender cylindrical stems; basal leaves reduced to bladeless sheaths; rhizomes firm, extensively forked; along brackish shores and margins of tidal marshes.

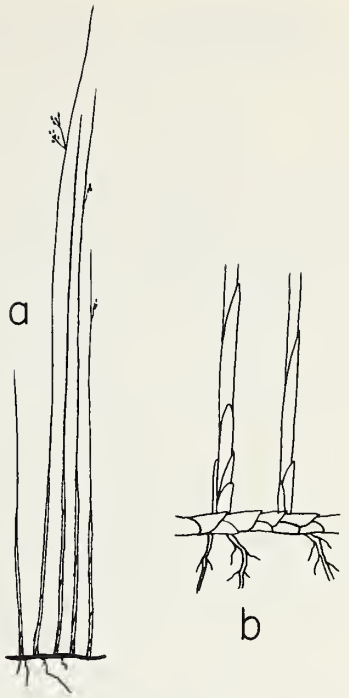


Figure 107.—(a) Habit sketch; (b) sheathing basal leaves × 1/10.

II. Dunes

Juncus spp.

Species of *Juncus* occur in the hollow of the dunes. Two species that are found are: *J. greenei* with flowers in loose cymes and resembles *J. gerardi,* and *J. canadensis* with flowers in subglobose clusters in a compound cyme. For identification of these, refer to one of the manuals or submit the specimen to a botanical taxonomist.

DISTRIBUTION OF PLANTS BY HABITATS

Vegetation of Beaches

Higher plants are confined to the extreme upper level of beaches. They grow in the sand, at the base of dunes or moraines, among cobbles and boulders or in the mass of plant debris deposited by storms. Only about 11 species of plants are regularly abundant in this extreme environment in southern New England. Many of them are quite succulent, which is a common characteristic of halophilic plants as well as plants that grow in deserts. A tension zone exists between the beach and the uplands where many common weedy plants will occur temporarily. The more common of these accidentals have also been included in key (Figure numbers refer to illustrations in the key).

1. Dominant beach plants:
   - *Cakile edentula* (Bigel.) Hook., Sea Rocket
     Fig. 40. Southern Labrador to South Carolina. Young tender leaves are good as a green. Horseradish flavor.
   - *Arenaria peploides* L. var. *robusta* Fern., Sea Purslane
     Fig. 34. Circumpolar species. Quebec to Maryland. (Arctic coast has other varieties. Seen on Hudson Bay.)
   - *Salsola kali* L., Saltwort
     Fig. 29. Southern Labrador to Georgia. Variety *caroliniana* (Walt.) Nutt. also occurs Massachusetts to Florida.
   - *Artemisia stelleriana* Bess., Dusty Miller, Silver King
     Fig. 69. Gulf of St. Lawrence to Virginia.
   - *Lathyrus japonicus* Willd., Beach Pea
     Fig. 53. Circumpolar species. The varieties extend from Hudson Bay to New Jersey. White variety rare.
   - *Polygonum glaucum* Nutt., Seabeach Knotweed
     Fig. 83. Massachusetts to Georgia.
   - *Atriplex patula* L. var. *hastata* (L.) Gray, Orach
     Fig. 35. Newfoundland south to South Carolina. Tender leaves can be used as a salad.
   - *Atriplex arenaria* Nutt., Seabeach Orach
     Fig. 36. Southern New Hampshire to Texas. Tender leaves can be used as a salad.
   - *Solidago sempervirens* L., Seaside Goldenrod
     Fig. 41. Newfoundland, Quebec to New Jersey, locally to Virginia. Other varieties to Florida, Texas, and Mexico.
   - *Xanthium echinatum* Murr., Cocklebur, Sea Burdock
     Fig. 38. Nova Scotia to Virginia.
   - *Euphorbia polygonifolia* L., Seaside Spurge
     Fig. 45. Prince Edward Island, east New Brunswick to Georgia.

2. Rare beach plants:
   - *Ligusticum scothicum* L., Scotch Lovage
     Fig. 56. Greenland and Labrador to southern New York.
   - *Glaucium flavum* Crantz., Horn or Sea Poppy
     Fig. 71. Southeastern Massachusetts and eastern Rhode Island south to Virginia.

3. Plants found growing on beaches, but not restricted to this habitat (many weed species):
   - *Chenopodium album* L., Pigweed or Lamb's Quarters
     Fig. 74. Cosmopolitan. Widespread along coast.
   - *Oenothera parviflora* L. var. *oakesiana* (Gates) Wieg., Small Flowering Evening-Primrose
     Fig. 79. Plymouth County, Mass., to Northampton County, Va. Look for *O. humifusa* Nutt. from New Jersey to Florida. *O. biennis* may also occur, as it is widely distributed.
   - *Convolvulus sepium* L., Wild Morning Glory
     Fig. 58. Newfoundland to Florida and Texas.
   - *Achillea millefolium* L., Yarrow
     Fig. 68. Cosmopolitan. Widely distributed. The crushed leaves have a strong disagreeable odor. If eaten by cattle

can cause odor and taste in milk and milk products.

Parthenocissus quinquefolia (L.) Planch., Virginia Creeper or Woodbine
Fig. 4. Southeastern Maine to Florida and Texas.

Polygonella articulata (L.) Meisn., Jointweed
Fig. 84. Maine to North Carolina.

Ambrosia artemisiifolia L., Ragweed
Fig. 72. Newfoundland to Florida and Texas. A pernicious weed. One of the causes of hay fever in the late summer.

Myrica pensylvanica Loisel., Bayberry
Fig. 19. Southern Newfoundland, eastern New Brunswick to North Carolina. Wax from the berries used formerly for candles.

Scleranthus annuus L., Knawel
Fig. 51. Prince Edward Island south to Florida.

Datura stramonium L., Jimson Weed
Fig. 75. Massachusetts to Pennsylvania. Locally northward and southward. A subcosmopolitan weed from South America, ill scented and poisonous. Frequently growing on plant debris on beaches.

Molluga verticillata L., Carpet Weed
Fig. 44. Nova Scotia, Quebec, south to Florida and Texas.

Linaria canadensis (L.) Dumont. Old Field Toadflax
Fig. 87. With the variety from Nova Scotia to Florida and Texas.

Rumex acetosella L., Sheep Sorrel
Fig. 60. Ubiquitous weed of worn out soils. Quebec to Virginia.

Sonchus oleraceus L., Common Sow Thistle
Fig. 70. Newfoundland and southward to Florida.

Spartina patens (Ait.) Muhl., Salt Marsh Hay
Fig. 94. Newfoundland to Virginia.

Ammophila breviligulata Fern., Beach or Marram Grass
Fig. 90. Newfoundland and southern Labrador to North Carolina. Planted to hold dunes and beaches.

Bromus tectorum L., Cheat
Fig. 101. Southern Quebec to Virginia.

Elymus virginicus L. var. *halophilus* (Bickn.) Wieg., Terrell Grass
Fig. 99. Nova Scotia to Virginia.

Suaeda maritima (L.) Dumont., Sea Blite
Fig. 30. Quebec to Virginia.

Suaeda linearis (Ell.) Moq., Sea Blite
Southern Maine to Florida and Texas.

Solanum nigrum L., Black Nightshade
Fig. 76a. Nova Scotia to Florida.

Solanum dulcamara L., Bittersweet, Nightshade
Fig. 76b. Newfoundland to Delaware.

Vegetation of Dunes

The dominant plants of sand dunes are listed below. Plants not restricted to dunes, but occurring there have been included. Some rare plants or accidentals are probably omitted. The zone number or numbers listed with each plant indicate the area of the dunes where these plants can generally be found (Fig. 108). The number of species increases from Zone I to Zone VI (Figure numbers refer to the key).

Zone I. From the beach to the top of the dune. Precipitous slope; frequently undercut by wave action.
Zone II. Crest of the primary dune. Exposed to effects of salt spray.
Zone III. Back slope of the dune protected from salt spray.
Zone IV. Hollow. Sandy with scattered vegetation; sometimes a small marsh or acid bog present; thickets of shrubs, usually in isolated stands, on mounds of accumulated sand.
Zone V. Secondary dune. The vegetation on the top may show the effects of salt spray. The back part of this dune may support a unique dune forest. In some cases the secondary dune is absent.
Zone VI. The transition zone to forest, tidal marsh, or a brackish pond. This zone may be found directly back of the front dune if the secondary system is missing.

Figure 108.—Distributional zones where the dominate plants of the sand dunes are generally found.

1. Dominant grass of the dunes:
Ammophila breviligulata Fern., Beach or Marram Grass
Fig. 90. Newfoundland and southern Labrador to North Carolina. Found in all Zones from I to VI, but becoming less frequent from III to VI. The grass

is planted to stabilize dunes. Replaced by *Uniola paniculata* from Virginia south.

2. Important plants associated with *Ammophila*:

   a. Herbaceous plants:

   Artemisia stelleriana Bess., Dusty Miller or Silver King
   Fig. 69. Gulf of St. Lawrence to Virginia. Zones I, II, III.

   Lathyrus japonicus Willd., Beach Pea
   Fig. 53. Circumpolar species. The varieties extend from Hudson Bay to New Jersey. White variety rare. Zones II, III, IV.

   Solidago sempervirens L., Seaside Goldenrod
   Fig. 41. Newfoundland, Quebec to New Jersey, locally to Virginia. Other varieties to Florida, Texas, and Mexico. Zones II, III, IV, V.

   Hudsonia tomentosa Nutt., Beach Heather, Poverty Grass
   Fig. 18. Gaspe Peninsula to North Carolina. Thoreau's poverty grass. *H. ericoides* may occur on the dunes. More usual in interior pine barrens. Zones III, IV, V, VI.

   Xanthium echinatum Murr., Cocklebur, Sea Burdock
   Fig. 38. Nova Scotia to Virginia. Zones II, III, IV, V.

   Lechea maritima Leggett., Seaside Pinweed
   Fig. 86. Southern Maine to east Virginia.

   b. Shrubby species:

   Prunus maritima Marsh., Beach Plum
   Fig. 15. Knox County, Maine, to Delaware. Fruit used for jelly. Zones II, III, IV, V, VI.

   Rhus radicans L., Poison Ivy
   Fig. 3. Nova Scotia to Florida and Texas. Poisonous to touch, many people sensitive. Zones III, IV, V, VI.

   Myrica pensylvanica Loisel., Bayberry
   Fig. 19. South Newfoundland, east New Brunswick to North Carolina. Wax from the berries formerly used for candles. Zones III, IV, V, VI.

   Rosa rugosa Thunb., Salt-Spray Rose
   Fig. 6. Nova Scotia to Delaware. Zones II, III, IV, V, VI.

   Quercus ilicifolia Mang., Scrub or Holly Oak
   Fig. 12. Maine to North Carolina. The oak of the pine barrens of New Jersey. Zones IV, VI.

   Juniperus virginiana L., Red Cedar, Juniper
   Fig. 2. Southeastern New England to Florida and Texas. Zones III, IV, VI.

   Baccharis halmifolia L., Sea Myrtle, Groundsel Tree
   Fig. 9. Massachusetts to Florida and Texas. Sexes separate; in the fall the female shrub has cottony tipped seeds. Zones IV, VI.

3. Additional characteristic plants growing in areas protected from wind and salt spray:

   Festuca rubra L., Red Fescue Grass
   Fig. 91. Greenland, Labrador to North Carolina. (Many varieties.) Zones III, IV, VI.

   Artemisia caudata Michx., Wormwood.
   Fig. 66. Southern Maine to Florida and Texas. Zones III, IV, V.

   Euphorbia polygonifolia L., Seaside Spurge
   Fig. 45. Prince Edward Island, east New Brunswick to Georgia.

   Atriplex arenaria Nutt., Seabeach Orach
   Fig. 36. Southern New Hampshire to Texas. Young leaves are useful in salads, or cooked as greens. Zones I, II, III.

4. Plants not exclusively dune plants, but growing in protected areas:

   Linaria canadensis (L.) Dumont., Old Field Toadflax
   Fig. 87. With the varieties from Nova

Scotia to Florida and Texas. Zones III, IV, VI.

Smilacina stellata (L.) Desf., False Solomon's Seal
Fig. 77. Southeastern Labrador to New Jersey. Zone VI.

Juncus canadensis J. Gay. Canadian Rush.
Maine to Georgia. Zone IV, possibly VI.

Juncus greenei Oakes & Tuckerm., Torrey's Rush
Nova Scotia to New Jersey. Zone IV, possibly VI.

Cyperus grayii Torr., Gray's Sedge
Massachusetts to Florida. Zone IV, possibly VI.

Deschampsia flexuosa (L.) Trin., Common Hairgrass
Fig. 92. Southern Labrador to North Carolina. Zone VI.

Rumex acetosella L., Sheep Sorrel
Fig. 60. Ubiquitous weed of worn-out soils. Quebec to Virginia. Zones IV, VI.

Lepidium virginicum (L.) R. Br., Peppergrass
Fig. 82. Widespread weed. Naturalized from Europe.

Chrysopsis falcata (Pursh.) El., Golden Aster
Fig. 89. Southeastern Massachusetts to New Jersey. Zones III, IV, V, VI.

Parthenocissus quinquefolia (L.) Planch., Virginia Creeper
Fig. 4. Southern Maine to Florida and Texas. Zones III, IV, V, VI.

5. Cryptogams of the dunes:

Geaster spp., Earth Stars
Massachusetts; Delaware. Bare sandy areas. Zones IV, VI.

Cladonia spp., Lichens
Widely distributed. Several species of *Cladonia* may occur between vegetation on bare areas. Zones II, III, IV, V, VI.

Usnea barbata, Old Man's Beard
Maine; Massachusetts. On beach blum and bayberry twigs. Zones II, III, IV, VI.

Aulacomnium palustre Schwaegr., Moss
Eastern North America. In wet hollows. Zones IV, VI.

Ceratodon purpureus (L.) Brid., Moss
Drier sites. One of the few mosses that grows regularly near the shore. Zones III, IV, VI.

Polytrichum piliferum Schreb., Hairy Cap Moss
Drier sites in hollows. Edges of bogs. *P. commune* may also occur at edge of bogs. Zones IV, VI.

Sphagnum spp., Sphagnum or Peat Moss
Cosmopolitan species. May form dominant plant in boggy areas in some hollows of dunes. Zones IV, VI.

6. Plants of the transition zone:

a. Dune forest to uplands:

i. Trees and shrubs:

Pinus rigida Mill., Pitch Pine
Fig. 1. Maine to Virginia. Sometimes Zone IV. Zone VI.

Prunus serotina Ehrh., Black Cherry
Fig. 16. Nova Scotia to Florida and Texas. Zones IV, V, VI.

Nyssa sylvatica Marsh., Sour Gum
Fig. 14. Maine to Florida and Texas. Zones V, VI.

Sassafras albidum (Nutt.) Nees., Sassafras
Fig. 10. Southern Maine to Virginia. Zones IV, V, VI.

Rhus copallina L., Dwarf or Shining Sumac
Fig. 5. Southern Maine to Florida and Texas. Zones IV, V, VI.

Ilex opaca Ait., American Holly
Fig. 11. Eastern Massachusetts to Florida and Texas. Zones V, VI.

Amelanchier laevis Wieg., Shadbush
Fig. 17. Newfoundland to Georgia. Species of *Amelanchier* hybridize readily and there

may be great variation. Other species of the genus may be present. Zones V, VI.

Populus tremuloides Michx., Quaking Aspen
Fig. 13. Labrador to Virginia. Zone VI.

Spiraea alba DuRoi., Meadowsweet
Fig. 24. Quebec to Delaware. Bog hollows. Zones IV, VI.

Spiraea tomentosa L., Hardhack, Steeplebush
Fig. 25. Prince Edward Island to North Carolina. *S. latifolia* may also occur. In the key it precedes Figure 24. In bog hollows. Zones IV, VI.

ii. Herbaceous plants:

Panicum virgatum L., Switch Grass
Fig. 100. Maine to Florida and Mississippi. *P. longifolium* grows in the same habitat, more southerly in distribution, occurs in southeastern Massachusetts. Zone VI.

Polygonella articulata (L.) Meisn., Jointweed
Fig. 84. Maine to North Carolina.

Gerardia maritima Raf., Seaside Gerardia
Fig. 46. Yarmouth County, Nova Scotia, to North Carolina. Zone VI.

Rosa palustris L., Swamp Rose
Fig. 7. Nova Scotia to Florida. *R. carolina* may also occur, less common. Zone VI.

Oenothera parviflora L. var. *oakesiana* (Gates) Wieg., Small Flowering Evening-Primrose.
Fig. 79. Plymouth County, Mass., to Northampton County, Va. Look for *O. humifusa* Nutt. from New Jersey to Florida. *O. biennis* may also occur, as it is widely distributed.

Ambrosia artemisiifolium L., Ragweed
Fig. 72. Newfoundland to Florida and Texas. A pernicious weed. One of the causes of hay fever in the late summer. Zone VI.

Lycopus rubellus Moench., Bugleweed
Fig. 49. Southern New England to Florida and Texas. Other species of the genus may be present. Zone VI.

Polygala palygama Walt. var. *obtusa* Chodat., Milkwort
Fig. 85. Nova Scotia to Florida and Texas. Zone VI.

Pteridium aquilinum (L.) Kuhn., Bracken Fern
Fig. 43. Cosmopolitan plant. Newfoundland to North Carolina. Zone VI.

Chrysanthemum leucanthemum L., Ox-Eye Daisy
Fig. 81. Labrador to Florida. Several varieties. A common but attractive weed. Zone VI.

Gnaphalium obtusifolium L., Cudweed, Common Everlasting
Fig. 80. Prince Edward Island to Florida and Texas. Zone VI.

b. Transition to tidal marsh:

Spartina patens (Ait.) Muhl., Salt Marsh Hay
Fig. 94. Newfoundland to Virginia. Zone VI.

Atriplex arenaria Nutt., Seabeach Orach
Fig. 36. New Hampshire to Texas. Zone VI.

Limonium carolinianum (Walt.) Britt., Sea Lavender
Fig. 61. Newfoundland to Florida and Mississippi. Flower panicles can be dried for winter bouquets. North of Cape Cod *L. nashii* is more common. Zone VI.

Spergularia marina (L.) Griseb., Sand Spurrey
Fig. 52. Quebec and south along

coast to Florida. *S. canadensis* may also occur. *S. diandra* is reported only from shores of Buzzards Bay, Mass. Zone VI.

Salsola kali L., Saltwort
Fig. 29. Southern Labrador to Georgia. Variety *caroliniana* (Walt.) Nutt. also occurs Massachusetts to Florida. Zone VI.

Lythrum salicaria L., Spiked Loosestrife
Fig. 47. Newfoundland to Virginia. Zone VI.

Phragmites communis Trin., Reed Grass
Fig. 96. Eurasia and with its varieties nearly cosmopolitan. Zone VI.

c. Transition to the brackish pond:

Pluchea purpurascens (Sw.) D. C. var. *succulenta* Fern., Salt Marsh Fleabane.
Fig. 39. Southern Maine to Florida. *P. camphorata* from Delaware south to Texas.

Cyperus odoratus L., Fragrant Sedge
Massachusetts to tropical America. Zone VI.

Cyperus rivularis Kunth., Sedge
Maine to Georgia. Zone VI.

Eleocharis spp., Sedge
Fig. 104. Mature seeds must be available to identify the species. It is suggested that references be consulted for complete identification. Zone VI.

Eleocharis parvula (R. & S.) Link.
Fig. 105. Newfoundland to Louisiana. Zone VI.

Ptilimnium capillaceum (Michx.) Raf., Mock Bishop's Weed.
Fig. 67. Southern New England to Florida and Texas. Zone VI.

Solidago tenuifolia Pursh., Goldenrod
Fig. 88. Nova Scotia south to Virginia. *S. graminifolia* (L.) Salisb. also found growing here. Quebec south to North Carolina. Zone VI.

7. Acid bogs in dune hollows (found at Chappaquoit Beach, Provincetown, and Monomoy Island). Plants in the Gray Museum, Marine Biological Laboratory, are in the collection from Monomoy Island.

a. Dominant plants:

Vaccinium macrocarpon Ait., Cranberry
Newfoundland to North Carolina. The small cranberry, *V. oxycoccus*, may also occur.

Sphagnum palustre L., Sphagnum or Peat Moss
Circumpolar, south into New Jersey. Other species of *Sphagnum* may be present.

Lycopodium inundatum L., Bog Club-Moss
Typical form and its varieties extend from Newfoundland to Florida and Texas.

Drosera rotundifolia L., Round-Leaved Sundew
Labrador to Florida. *D. intermedia* Hayne, the intermediate leaved species may also occur.

b. Less common plants:

Viola lanceolata L., Lance-Leaved Violet
New Brunswick to Florida.

Pogonia ophioglossoides (L.) Ker., Pogonia Orchid
Newfoundland to Florida and Texas.

Calopogon pulchellus (Sal.) R. Br., Grass Pink
Newfoundland to Florida and Texas.

Spiraea tomentosa L., Hardhack, Steeplebush
Fig. 25. Prince Edward Island to North Carolina. *S. alba* and *S. latifolia* may also occur. See dune forests. Usually on the edge of the bog.

Polytrichum commune L., Hairy Cap Moss
Cosmopolitan. Edge of the bog.

Onoclea sensibilis L., Sensitive Fern
Southern Labrador to Florida and Texas. Sensitive to frost.

8. Sea cliffs (vegetation of the top of the cliffs along the eastern shore of Cape Cod. These are moraines):

a. Trees:
Juniperus virginiana L., Red Cedar, Juniper
Fig. 2. Southeastern New England to Florida and Texas.
Pinus rigida Mill., Pitch Pine
Fig. 1. Maine to Virginia.
Rhus copallina L., Dwarf or Shining Sumac
Fig. 5. Southern Maine to Florida and Texas.
Sassafras albidum (Nutt.) Nees., Sassafras
Fig. 10. Southern Maine to Virginia. The bark of the roots is dried and used for tea.
Prunus maritima Marsh., Beach Plum
Fig. 15. Knox County, Maine, to Delaware. Fruit used for jelly.
Prunus serotina Ehrh., Black Cherry
Fig. 16. Nova Scotia to Florida and Texas.

b. Shrubs and vines:
Rhus radicans L., Poison Ivy
Fig. 3. Nova Scotia to Florida and Texas. Poisonous to touch, many people sensitive.
Parthenocissus quinquefolia (L.) Planch., Virginia Creeper, Woodbine
Fig. 4. Southeastern Maine to Florida and Texas.
Rosa rugosa Thunb., Salt-Spray Rose
Fig. 6. Nova Scotia to Delaware.
Rosa palustris Marsh., Marsh or Swamp Rose
Fig. 7. Nova Scotia to Florida. *R. carolina* may also occur.
Myrica pensylvanica Loisel., Bayberry
Fig. 19. South Newfoundland, east New Brunswick to North Carolina. Wax from the berries formerly used for candles.
Comptonia peregrina (L.) Coult., Sweet Fern
Fig. 20. Cape Breton Island to Virginia. (Not a fern.)
Gaylussacia baccata (Wang.) K. Koch., Black Huckleberry
Fig. 23. Newfoundland to Georgia.
Arctostaphylos uva-ursi (L.) Spreng., Bearberry
Fig. 21. Newfoundland to Virginia. May form a solid ground cover.
Smilax rotundifolia L., Common Greenbriar
Fig. 73. Newfoundland to Florida and Texas. Other species may be present.

c. Grasses:
Ammophila breviligulata Per., Dune or Marram Grass
Fig. 90. Newfoundland and southern Labrador to North Carolina. This grass is frequently planted to stabilize dunes. Replaced by *Uniola paniculata* from Virginia south.
Festuca rubra L., Red Fescue Grass
Fig. 91. Greenland, Labrador to North Carolina. Many varieties.
Deschampia flexuosa (L.) Trin., Common Hairgrass
Fig. 92. South Labrador to North Carolina.
Agrostis alba L. var. *palustris* (Huds.) Pers., Redtop Grass
Fig. 98. Newfoundland south to Georgia and Louisiana.

d. Herbs (the commonest are given, some others are expected but rare):
Solidago sempervirens L., Seaside Goldenrod
Fig. 41. Newfoundland, Quebec to New Jersey. Locally to Virginia.

Lathyrus japonicus Willd., Beach Pea
Fig. 53. Cirumpolar species. The varieties extend from Hudson Bay to New Jersey. White variety rare.

Lupinus perennis L., Wild Lupine
Fig. 55. Southern Maine to Florida.

Baptisia tinctoria (L.) R. Br., Wild Indigo
Fig. 57. Maine to Florida. Plant turns black when pressed for herbarium. Used at one time for a blue dye.

Rumex acetosella L., Sheep Sorrel
Fig. 60. Ubiquitous weed of worn-out soils. Quebec to Virginia.

Hypochoeris radicata L., Cat's Ear
Fig. 62. Newfoundland to North Carolina.

Hieracium venosum L., Hawkweed, Rattlesnake Weed
Fig. 63. Southern Maine to north Virginia, along the coast. Other hawkweeds may be present.

Artemisia stelleriana Bess., Silver King, Dusty Miller
Fig. 69. Gulf of St. Lawrence to Virginia.

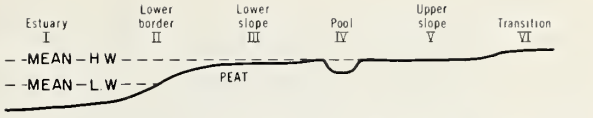
Chrysanthemum leucanthemum L., Ox-Eye Daisy
Fig. 81. Labrador to Florida. Several varieties.

Polygala polygama Walt. var. *obtusa* Chodat., Milkwort
Fig. 85. Nova Scotia to Florida and Texas.

Linaria canadensis (L.) Dumont., Old Field Toadflax
Fig. 87. With the variety from Nova Scotia to Florida and Texas.

Vegetation of Tidal Marshes

The dominant plant species of the tidal marshes are listed below. Rare plants may have been missed or intentionally omitted. Zone numbers in the diagram (Fig. 109) will be used to indicate the areas in which each plant commonly grows. The number of species increases from Zone I to VI.



Zone I. Estuary. The bottom may be sandy, sand and mud, or cobbles. Mostly covered with water, but may be fringed by a flat exposed at low tide.
Zone II. Lower Border. Edge of the marsh, also along creeks and ditches; normal tides flood the area twice a day; few species present. *Spartina alterniflora* zone.
Zone III. Lower Slope. Are subjected to the higher tides. At some seasons there may be intervals of no tidal flooding. *Spartina patens* zone.
Zone IV. Pool. Filled with water; salinity varies with tidal influx or long periods without flooding; may reach salinity of 56 ‰ or more in summer.
Zone V. Upper Slope. Areas subjected to exceptionally high tides and storm waters. *Juncus gerardi* zone.
Zone VI. Transition. (Upper Border). Area subjected to storm tides only; upland vegetation taking over and mixed with typical tidal marsh plants.

Figure 109.—Distributional zones where the dominate plants of the tidal marshes grow.

1. Submerged flowering plants:
   Zostera marina L., Eel Grass
   Fig. 26. Zone I. Both shores of the Atlantic. Greenland to North Carolina. Turtle grass takes over from North Carolina southward. Always submerged, cannot survive if exposed to desiccation by the lowering tidal waters.
   Ruppia maritima L., Widgeon Grass
   Fig. 28. Zones I, IV. Nearly cosmopolitan species. The typical plant and its varieties from Newfoundland to Florida, West Indies, and Mexico. Quiet estuaries and brackish ponds. Important as food for ducks and other wild fowl.
   Potamogeton pectinatus L., Sago Pond Weed
   Fig. 27. Zone IV. Newfoundland to Florida and Texas. Brackish ponds. Important wild fowl food.

2. Dominant grasses and rushes:
   Spartina alterniflora Loisel., Salt Marsh Cord Grass
   Fig. 93. Zone II dominant. Nova Scotia to Florida and Texas. Important producer of the tidal marshes. Dwarf form, rarely blooms in Zone III.
   Spartina patens (Ait.) Muhl., Salt Marsh Hay
   Fig. 94. Newfoundland to Virginia. Zone III dominant, at end of growing season shows "cowlick" formation.

Distichlis spicata (L.) Greene, Spike Grass, Alkali Grass

Fig. 97. Prince Edward Island south to Florida and Texas. Zones III, V. Common invader of the bare tidal marsh pannes.

Juncus gerardi Loisel., Black Grass

Fig. 106. Newfoundland to Florida. Dominant in Zone V. A rush, not a grass. Its place taken further south by *J. roemerianus*—Georgia to Texas, north to Maryland.

Panicum virgatum L., Switch Grass

Fig. 100. Maine to Florida and Mississippi. *P. longifolium* grows in same habitat, more southerly in distribution, occurs in southeastern Massachusetts. Dominant in Zone VI, the substratum frequently may be acid here.

Phragmites communis Trin., Reed Grass

Fig. 96. Eurasia and with its varieties nearly cosmopolitan. Quebec to Louisiana and Texas. Zone VI.

Festuca rubra L., Red Fescue Grass

Fig. 91. Greenland, Labrador to North Carolina. Many varieties. Zone VI.

Agrostis alba L. var. *palustris* (Huds.) Pers., Redtop Grass

Fig. 98. Newfoundland south to Georgia and Louisiana. Zone VI.

3. Important herbs with dominant grasses and rushes:

Limonium carolinianum (Walt.) Britt., Sea Lavender

Fig. 61. Newfoundland to Florida and Mississippi. Flower panicles can be dried for winter bouquets. North of Cape Cod *L. nashii* is more common. Zones II, III, V.

Solidago sempervirens L., Seaside Goldenrod

Fig. 41. Newfoundland, Quebec to New Jersey, locally to Virginia. Varieties to Florida, Texas and Mexico. Zones III, V, VI. Blooms mostly in September.

Suaeda maritima (L.) Dumont., Sea Blite

Fig. 30. Quebec to Virginia. Zones II, III, rarely V.

Suaeda linearis (Ell.) Moq., Sea Blite

Southern Maine to Florida and Texas. Zones II, III, rarely V.

Salicornia virginica L., Perennial Glasswort

Fig. 31. Southern New Hampshire to South Carolina. Zones II, III, usually bare areas. All species of *Salicornia* are edible, can be used to spice up a salad.

Salicornia europaea L., Samphire

Fig. 33. Nova Scotia south to Georgia. Zones II, III. Usually recolonizing bare areas, but sometimes forms a turf below the grasses.

Salicornia bigelovii Torr., Dwarf Saltwort

Fig. 32. Southern Maine to South Carolina. Zones II, III. Bare areas.

Aster tenuifolius L., Marsh Aster

Fig. 42. New Hampshire to Florida and Mississippi. Zones II, III. (*Aster subulatus* Michx., an annual, also occurs in this region. New Brunswick to Delaware.)

Pluchea purpurascens (Sw.) D. C. var. *succulenta* Fern., Salt Marsh Fleabane

Fig. 39. Southern Maine to Florida. *P. camphorata* from Delaware south to Texas. Zones III, V, VI.

Ptilimnium capillaceum (Michx.) Raf., Mock Bishop's Weed

Fig. 67. Southern New England to Florida and Texas. Zones III, V.

Plantago oliganthos R. & S., Seaside Plantain

Fig. 37. Southern Labrador and Newfoundland to New Jersey. Zone III. Sometimes on bare areas or pannes. *P. juncoides* may be present.

Atriplex patula L. var. *hastata* (L.) Gray., Orach

Fig. 35. Newfoundland south to South Carolina. Zones V, VI. Young tender leaves can be used as a salad or green.

Spergularia marina (L.) Griseb., Sand Spurry

Fig. 52. Quebec and south along coast to Florida. *S. canadensis* may occur. *S. diandra* is reported only from shore of Buzzards Bay, Mass. Zone VI.

Triglochin maritima L., Arrow-Grass
Fig. 59. Labrador to Delaware. Zones III, V.

Potentilla egedei Wormsk. var. *groenlandica* (Tratt.) Polunin., Silver Weed
Fig. 54. South Greenland to Long Island.

Eleocharis parvula (R. & S.) Link
Fig. 105. Newfoundland to Louisiana.

4. Shrubs:

Iva frutescens L. var. *oraria* (Bartlett.) Fern. & Grisc., Marsh Elder, High Tide Bush
Fig. 8. With its varieties from west Nova Scotia to Virginia. Zone III, V; on elevations on the marsh, VI.

Baccharis halmifolia L., Sea Myrtle, Groundsel Tree
Fig. 9. Massachusetts to Florida and Texas. Sexes separate, in the fall the female shrub has cottony tipped seeds. Zones V, VI.

5. Conspicuous algae of the marsh:

Ascophyllum nodosum (L.) LeJolis f. *scorpioides* (Hornemann) Reinke
Nova Scotia to New Jersey. Zone II. Tangled masses at the base of *Spartina alterniflora* and sometimes in Zone III at the base of *Salicornia virginica*. No sexual reproduction in this form. Great variation in the form.

Fucus vesiculosus L., Bladder Wrack
Ellesmere Island to North Carolina. Variety *spiralis* may be found here. Zone II at base of *Spartina alterniflora*.

6. Plants of the transition, brackish to freshwater border of the marsh:

Hibiscus palustris L., Swamp Rose Mallow
Fig. 22. Massachusetts to North Carolina. Zone VI—pink blossom dominant on the Cape, white form with pink center also occurs. *H. moscheutos* occurs from Maryland to Florida.

Scirpus americanus Pers., Three-Square Rush
Fig. 102. Newfoundland to Florida and Texas. Zone VI. Forms almost pure stands around pools.

Scirpus torreyi Olney., Torrey's Rush
New Brunswick to Long Island. Zone VI. *S. olneyi* should also be expected in brackish marshes. Found in Delaware.

Scirpus paludosus Nels. var. *atlanticus* Fern.
Fig. 103. Anticosti Island to lower St. Lawrence River south to New Jersey.

Spartina pectinata Link., Fresh Water Cord Grass
Fig. 95. Prince Edward Island to New Jersey. Zone VI.

Elymus virginicus L. var. *halophilus* (Bickn.) Wieg., Terrell Grass
Fig. 99. Nova Scotia to Virginia. Zone VI.

Eleocharis spp., Sedge
Fig. 104. Mature seeds must be available to identify to species. It is suggested that references be consulted for complete identification. Zone VI.

Lobelia cardinalis L., Cardinal Flower
Fig. 78. New Brunswick to Florida and Texas. Freshwater marshes at edge of tidal marsh. Zone VI.

Lythrum salicaria L., Spiked Loosestrife
Fig. 47. Newfoundland to Virginia. Zone VI.

Amelanchier laevis Wieg., Shadbush
Fig. 17. Newfoundland to Georgia. Species of *Amelanchier* hybridize readily and there may be great variation. Other species of the genus may be present. Zone VI.

Juncus balticus Willd.
Fig. 107. Labrador to Pennsylvania.

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Publication of the "Marine Flora and Fauna of the Northeastern United States" is most timely in view of the growing universal emphasis on environmental work and the urgent need for more precise and complete identification of coastal organisms than has been available. It is mandatory, wherever possible, that organisms be identified accurately to species. Accurate scientific names unlock the great quantities of biological information stored in libraries, obviate duplication of research already done, and make possible prediction of attributes of organisms that have been inadequately studied.

Dr. Edwin T. Moul began his study of the flora of New England in the summer of 1947 when he started teaching in the marine botany course of the Marine Biological Laboratory. In 1950 he prepared an unpublished report on the vascular flora of Great Pond, and in 1962, in association with the Systematics-Ecology Program, he commenced the field studies and syntheses which resulted in this manual.

Manuals are available for purchase from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The manuals so far published in the series and their cost per copy are listed below.

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349. Use of abstracts and summaries as communication devices in technical articles. By F. Bruce Sanford. February 1971, iii + 11 pp., 1 fig.

350. Research in fiscal year 1969 at the Bureau of Commercial Fisheries Biological Laboratory, Beaufort, N.C. By the Laboratory staff. November 1970, ii + 49 pp., 21 figs., 17 tables.

351. Bureau of Commercial Fisheries Exploratory Fishing and Gear Research Base, Pascagoula, Mississippi, July 1, 1967 to June 30, 1969. By Harvey R. Bullis, Jr., and John R. Thompson. November 1970, iv + 29 pp., 29 figs., 1 table.

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